JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1832.

An examination of Mr. Espy's remarks relative to the application of water upon the wheels at Fair Mount Water Works.

TO THE COMMITTEE OF PUBLICATION OF THE FRANKLIN INSTITUTE.

GENTLEMEN,—At page 73 of the current volume of the Journal of the Franklin Institute, I find Mr. J. P. Espy's remarks on an article which appeared in the fourth volume of the Franklin Journal, over the signature "L. M." I have only seen as much of the latter article as is quoted by Mr. Espy. Upon this he remarks, "Upon reading that part of the essay which relates to our works at Fair Mount, I was surprised to find a disparity between the power and the effect so great as three to one." And again he says, "the writer has also estimated too high the retarding influence of the inertia of the water put in motion by the buckets with a velocity equal to the difference of the velocity of the bucket, which is twelve feet, and the velocity of the water in the direction of the circumference of the wheel. This difference, on the supposition that the water comes on the wheel one foot from the surface, at an angle of forty-five degrees, is six and one-third feet."

The whole loss of power is estimated by "L. M." thus—"The velocity of the water in the required direction is that which is due to a fall of five and two-thirds inches.

"Immediately on striking the wheel it receives a velocity due to a fall of twenty-seven inches.

"The difference indicates the power expended by the wheel in giving it that velocity, - - 21½ inches

"The water comes on the wheel below the surface of the dam, - - 12 inches

"Total loss, - - 33½ "

Mr. Espy then says, "It appears to me that the following method of calculating is the true one—

"The velocity of the water in the required direction is five and a half feet; immediately on striking the wheel it receives an additional velocity of six and a half feet, due to a head of 8 inches

"The water comes on the wheel below the surface of the dam, - - - 12 inches

"Total loss, - - 20 inches."

From the foregoing statements, Mr. Espy arrives at (what I conceive to be) the erroneous conclusion, that water let on to a wheel, at a less velocity than that of the wheel itself, will give a maximum effect.

It appears to me that "L. M." has erred in supposing that water in motion at a velocity due to one foot head, viz. eight feet per second, at an angle of forty-five degrees, to the direction of the wheel, would oppose a resistance to the buckets, by the influence of its inertia, proportioned to the difference between the velocity of the wheel, and that of the water in the *direction of the wheel*, to wit, six and a half feet. This error is obvious from the fact, that the water strikes the soaling of the wheel at an angle of forty-five degrees, by which its motion, instead of being destroyed, is only changed to the direction of the wheel's motion; hence, all that can be lost by this change of direction is, what may be occasioned by the agitation of the water, and therefore it moves in the direction of the wheel at a velocity but little less than eight feet per second. If no part of the water should reach the soaling, and have its direction changed before the bucket had urged its velocity to twelve feet, "L. M.'s" statements would be correct.

Mr. Espy first sanctions "L. M.'s" error in relation to the action of the first motion of the water, by supposing it to receive from the bucket an additional motion of six and a half feet, when, in fact, it receives from that source but little more than four feet per second. Next he falls into the greater error, of *first principles*, to which, if he goes back, he will find that, when water is falling, or moving, at the rate of five and a half feet per second, a power equal to a head of eight inches will not increase its velocity six and a half feet, or raise it from five and a half to twelve feet per second, any more than the velocity of a heavy body could be increased from thirty-two to sixty-four feet by the same quantity of power that gave it the first motion of thirty-two feet.

By the recollection "that water produces a greater mechanical effect by gravity than by impulse, the paradox will" *not* "vanish;" for it follows as a corollary, that if water cannot communicate its

whole power by impulse, it cannot receive the *whole* of any expended power by the same action.

I will here leave the subject for the present with the fullest confidence that Mr. Espy will at once see the error into which he has inadvertently fallen, and that he will as promptly correct it.

I feet confident also that he will perceive that no calculation, founded on sound principles, can lead to a conclusion that any velocity of the water, less than that of the wheel, can give a maximum effect.

As this subject has reference to our important works at Fair Mount, where the most economical use of water may *soon* be much more important than it is at present, any suggestions tending to improvement in this department of the works, may not be considered premature at this time. From the foregoing, it appears that in the present arrangement, twenty-seven inches, or more than twenty-eight per cent. of the head is lost by reason of the high velocity of twelve feet per second, at which this arrangement requires that the wheel should run: to which is added the loss sustained by the oblique direction of the water to a tangent to the wheel at the point of application, as noted above. To obviate most of the loss thus sustained, I will suggest a modification of the present arrangement, as follows: In place of the wheels now in use, the largest of which I believe is eighteen feet, I would apply three wheels of seven feet diameter each, for which I believe there is ample room. To these I would apply the water by what is termed the *pitchback overshot* principle, and drive them four and two-thirds feet per second, at which rate the same number of revolutions will be made as with the present wheels at twelve feet per second. The combined velocity of the three wheels will be fourteen feet, and will be competent to do more work than one wheel moving twelve feet in the proportion of fourteen to twelve, and will permit the stroke of the pump to be increased in the same ratio. With a velocity of four and two-thirds feet in the wheels, the effect of the water by *impulse* under a head of one foot, will be equal, nearly, to half the effect of the same quantity acting by gravity; hence, the whole loss of head will be but a fraction more than six inches, instead of more than twenty-seven inches, by the present arrangement. These wheels may be connected with each other by segments on their peripheries, or, by the simple and cheap application of two connecting rods. Each of these may connect the crank of an outside wheel to the common crank of the centre wheel, and this last may be connected with the pump on the present plan. These three wheels, with their connexions, will weigh, and cost, but little more than one wheel of eighteen feet diameter, and the frictions will be but little increased.

Very respectfully, yours,

C.

FRANKLIN INSTITUTE.

Reports of the Committee on Inventions.

The committee on inventions, appointed by the Franklin Institute, for the promotion of the mechanic arts, to whom was referred the consideration of the several subjects annexed, present the following reports, viz.—

On James Spicer's plan for Transporting the Mail, &c.

Mr. Spicer proposes to transport the mail, &c. between any two given points by the following arrangement. Tubes (of wood or metal) of uniform bore, are to be placed horizontally, and in a direct line between the two points; within these tubes the mail is to be moved. To effect this motion the mail is to be attached to an air-tight plug, moved by condensing the air upon one side of the plug, and rarifying it upon the opposite side. Mr. Spicer proposes to divide the distance between any two large towns, (as, for example, between Philadelphia and New York,) into sections of five miles each; an engine for condensing, (or exhausting,) being placed at one end of the section, while another for exhausting, (or condensing,) is placed at the opposite end. It is understood that it is proposed to use tubes ten inches in diameter.

To examine this device the first inquiry should be directed to ascertaining whether it is good or bad in theory, and if good in theory it would then remain to examine whether it is practically good, and finally, to estimate the cost of its application as compared with other modes of conveyance, as by rail-roads, &c.

The first question, in point of magnitude, in the theoretical examination of this machine is, do the known laws of the motion of elastic fluids, warrant us in concluding that air can be compressed and exhausted in the manner proposed? That air has inertia is proved by the familiar illustrations of its force when in motion, and its resistance, when at rest, to a body moving throught it. That air in passing through a tube would be retarded by friction is reasonable to suppose from the laws which apply to other fluids. To determine the amount of this resistance recourse must be had to experiment, from which alone, the data for correctly solving such problems can be obtained.

Many experiments have been made upon this subject, possessing various degrees of merit.* In an experiment made in England, by Wilkinson, the whole force of a large hydraulic wheel could not force air to the distance of 320 yards through a pipe one foot in diameter. Girard found that a pipe of .6 of an inch in diameter, and 364 feet long, diminished the discharge of air by .9. Other experimenters have made the expense due to resistance in passing through tubes, less; as those of Clement Desormes, in which a loss of thirty-

* Annales des Mines, vol. ii. D'Aubuisson sur les Machines Soufflantes à Piston.

five per cent. was produced in a pipe ten inches in diameter, and 1490 feet in length.

D'Aubuisson in an elaborate series of experiments,* made at the mines of Rancié, has investigated the amount of resistance experienced by air in passing through tubes of various lengths and diameters. The diameters experimented upon, were four inches, two inches, and one inch. The length from twenty yards up to 430 yards, (nearly one-fourth of a mile,) varying by lengths of twenty yards. The force of the air at the different points was measured by syphon gauges at opposite ends of any pipe; the difference in height of the two gauges measuring the force expended in overcoming the resistance of the air to motion through the pipe. From these experiments results a formula by which, having given the pressure of the air at one extremity of a tube, in inches of mercury, the diameters of the tube at the two extremities, the length of the tube, the height of the barometer which measures the pressure of the external air, and the temperature of the air, the pressure at the opposite end of the pipe may be found.

For the purposes of our examination, we may assume the air at 32° Fah. (0° of centigrade scale,) and neglect the effect of the increase of temperature by condensation, and its decrease by rarifaction. The diameter of the tube is also to be taken the same throughout, viz. ten inches. The height of the barometer is assumed at thirty inches. With these data the following table has been calculated from the formula, assuming that at one end of the tube there is placed a steam engine capable of effecting a condensation equal to eleven atmospheres. The first three columns give the lengths of the tube in different denominations, the fourth shows the effect at the end of this tube in terms of inches of mercury, as shown by a gauge at that point; the fifth the total elastic force of the air at the several distances, and the sixth the ratio of the compression at the two extremities, or the ratio of effect produced to force expended.

Condensation at the beginning of the tube 330 inches of mercury, or eleven atmospheres.	Miles	Feet.	Inches.	Effect in inches of mercury.	Total pressure at the several distances.	Ratio of total pressure to force expended.
	0			300.0	330.	1.
		20	240	287.2	317.2	.961
	$\frac{1}{8}$	660	7,920	118.1	148.1	.449
	$\frac{1}{2}$		31,680	58.6	88.6	.267
	1		63,360	37.7	67.7	.205
	2		126,720	23.4	53.4	.162
	$2\frac{1}{2}$		158,400	19.7	49.7	.150
	3		190,080	17.5	47.5	.144
	4		253,440	14.0	44.0	.133
	5		316,800	11.6	41.6	.126

* D'Aubuisson, sur la Résistance de l'Air dans les tuyaux de Conduite. Annales des Mines, 2nd series, vol. iii. 1828.

We see by the table just given, that in a tube of only one-eighth of a mile in length, about five-tenths of the power applied is consumed in overcoming the resistance to the motion of air through the tube; that at a distance of half a mile seventy-three per cent. of the power applied is expended in the same way, and that at two and a half miles there remains as an effective propelling force, but fifteen per cent. of the whole power applied. Exhibiting a consumption of power which puts out of the question the adoption of such a plan. By similar means, the effect of exhaustion at the opposite end of the tube might be calculated, and since the same sources of resistance exist in this case as in the other, the conclusion can but be of a similar kind. The foregoing table shows that in a tube of twenty feet in length, the resistance would be altogether inconsiderable, and hence, in the model of Mr. Spicer, eighteen feet long, notwithstanding its small diameter, he was not enabled to detect any resistance which would have led to an abandonment of his plan. The committee can but regret that expenses should have been incurred by Mr. Spicer in bringing his invention before the public, which they understand he is ill able to afford.

The committee have hitherto considered this subject without reference to the question of its novelty, because they wished that the question of theory might be fairly met, and because they believe the idea to be original with Mr. Spicer, and therefore the credit of whatever ingenuity may be perceived in it, to be his due. In justice, however, to themselves and to the public, they must state that a patent was taken out in England in 1824, for a project in some sort similar to this. This patent which bears date February 19, 1824, was granted to John Vallance, of Brighton, "for producing locomotion by stationary engines." The design of the patentee was as follows: an air tight tunnel, of about eleven feet in diameter was to be provided, within which, upon a rail-way, carrriages for the transportation of goods and passengers, were to move: these carriages were to be attached to a shield fitting air-tight within the tunnel, and motion to be communicated to the shield by exhausting the air in front of it by an engine stationed at the end of the tunnel towards which the shield was to be moved; the pressure of the atmosphere upon the opposite side of the shield would thus be the propelling force.

The plan of Mr. Spicer differs from this in being upon a much smaller scale, and for a more limited object, which is decidedly in its favour when compared with the other. A further difference is to be found in his use of the compression of air, as well as of its exhaustion.

On Franklin Peale's Moveable Diagrams for illustrating the construction of the Steam Engine.

The moveable diagrams submitted by Mr. Peale to the examination of the committee, are three in number, the first illustrative of

the locomotive engine, the second of the ordinary low pressure engine, the third exhibiting the mode of operation of the trunk valve and of the forcing pump of the engine.

The first diagram is a longitudinal section and front view of the locomotive engine, exhibiting the structure of the boiler, its connexion with the cylinder, the transference of the motion of the piston rod to the wheels of the locomotive carriage, with the more important details belonging to the engine and carriage. The diagram is of pasteboard, neatly and perspicuously coloured. The parts to which motion is to be communicated, in the working of the engine, are formed of separate pieces of pasteboard, attached to each other by means which permit motion; each piece having the place which the part represented by it would occupy in a working engine: the assemblage thus composes an accurate representation of the machine, in which each part is free to take the motions which it really has in practice. Hence, while we are admitted to a full view of the interior of the machine, as by a faithful drawing, we see at the same time, and may study, the working of all the parts, as from a transparent model. In the diagram described, motion being communicated by the hand to one of the wheels of the carriage, the piston of the engine is seen to rise and fall; this motion seems to be transferred to the wheels, upon the axle of one of which an eccentric moves, giving play to the slide valve, thus seeming to continue motion to the piston by alternately admitting the steam from the boiler above and below the piston, and allowing its escape at corresponding periods from the opposite sides; the forcing pump by which the boiler is supplied with water, also is seen in action.

The second diagram is a highly finished representation of the low pressure engine, in which are clearly shown the communication of motion from the piston rod to the working beam, thence to the crank, the action of the fly wheel, of the eccentric in working the valves, of the cold and hot water pumps, and of the air pump; the engine may thus be studied in any of its working positions, and the relations of the parts in any one of these positions distinctly shown.

The third diagram is supplementary to the others, exhibiting in detail the working of the trunk valve, in its connexion with the cylinder, and with the positions of the piston, and also the working of the air pump; the valves of the pump are made to rise and fall alternately by a simple arrangement behind the diagram, and connected with the motion of the pump rod, so that the induction valve opens, as in practice, on the ascent of the piston, whilst the eduction valve closes, and vice versa, on the descent of the piston.

These moveable diagrams combine two qualities rarely united in the same apparatus. While they give a perfect representation of the machines to be illustrated, and therefore afford as elevated a means of demonstration as can be adopted, they furnish at the same time the most simple and pleasing method of exhibition; they are, in other words, equally valuable instruments for scientific or for popular illustration.

The committee give to this design their unqualified approbation.

On Charles Goodyear's Spring and Lever Fauset.

The committee are of opinion that Mr. Goodyear's spring and lever fauset is good in principle; the valve which closes the aperture being pressed down by means of a spiral spring, and in addition thereto, the pressure of the fluid contained in the vessel assists in making it tight; it is opened by means of a small lever, and in consequence of the valve not being subjected to friction, will not be liable to get out of repair. If properly made, the committee believe that these fausets will be superior to any other kind now in use.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1831.

With Remarks and Exemplifications, by the Editor.

1. For *Beds with elastic steel springs of coiled wire;* Alonzo G. Hull, city of New York, October 1.

This bed is intended principally for the use of invalids, but it is said that it will be found very acceptable to others; the construction of the bed is very complex, as its whole surface is to be formed of separate cushions, which are cubes of three or four inches. Each of these cushions is to be sustained by a spiral spring, placed vertically, about an inch in diameter and six inches long. To connect the whole a sort of coat of mail is to be made of sheet iron, or other metal, by loosely uniting together quadrangular plates of three, or more, inches square; this may be effected by punching four holes in each plate, one on each side, at equal distances from its angles, and connecting together by rings a sufficient number of them to give the desired surface. One of the cubical cushions is to be fastened on each of these plates, and the springs are to bear against their under sides.

There is to be a floor, or platform of wood, in the usual place of the sacking bottom. This floor is to be in three parts, in order that the head portion of the bed may be raised, and the foot portion depressed, which is to be done by means of pulleys, in the manner of other invalid bedsteads. The lower ends of the springs are to be attached to the floor in a peculiar way, in order to allow of the raising of any particular part, or section, of the bed, according to the state and requirements of the patient. We shall not attempt to describe this contrivance, or several other auxiliary appendages. This method of raising any part of the bed is, however, a principal point in the claim of the patentee.

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2. For a *Machine for planting Corn and other seeds;* Henry Todd, Pembroke, Merrimack county, New Hampshire, October 1.

In the planting machine here described, there is a round box to contain the seed, which box is fixed upon a suitable platform, and in this platform there is a hole to allow the seed to pass. Within the

box, and resting on the platform, is a revolving bottom, which fills the whole diameter of the box; and in which there are two, three, or more holes, at regular distances, that coincide with those in the platform, so that the seeds may be dropped as they pass over it. A wheel pressing on the ground and having a bevil gear, gives motion to the revolving bottom. This apparatus, it is said, may be attached to a common plough, or, in preference, to one made for the purpose. The claim is to "the principle, application, and operation of said machine." There is nothing new in the *principle*, as it has been frequently used; and the patentee, therefore, could only be entitled to his own particular mode of applying it.

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3. For a *Cooking Stove;* Samuel Beals, Boston, Massachusetts, October 1.

The patentee observes, in the commencement of his specification, that he does not claim any thing new in the particular parts, but only in the general arrangement of his stove, which is intended for the burning of anthracite, or other fuel.

The body of the stove is, we suppose, to be made of cast iron; it has an open front, somewhat like that of an open, or Franklin, stove. There is a grate at bottom, but no bars in front, the furnace part being sunken, and lined all round with fire brick. There is, of course, an ash pit, to admit a draft of air under the coals. There are holes through the top for boilers; and a crane on which to hang a kettle is affixed to one side. The flue is at the back, and steam pipes from the kettles lead into this flue. An apparatus much like the common tin kitchen is used for baking, or roasting, and is so made as to fit into, and entirely to close, the open front. Doors open at the back of this apparatus, to admit of the necessary attentions of the cook.

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4. For a *Secret Bedstead for sofas and settees;* Williams Woolley, city of New York, October 3.

In the specification now before us, Mr. Woolley refers to a patent which he formerly obtained for bedsteads, observing that "the ground of the principle is the same" in the present instance. The bedstead, it is said, may be either extended from the front, or the back, or drawn out from the top of the sofa; the seat and cushion, in the latter case, forming a part of the bedstead.

Bedsteads constructed in the way proposed by the patentee, were common in former days, having been made to fold up into the appearance of common settees, sofas, bureaus, and other articles of furniture. The seat of a sofa, upon one of the plans proposed, is to rise upon hinges against the back; the bedstead, which is folded in joints beneath it, is to be drawn out, the sofa seat closed down, and the bedstead is thus made ready for use. What there is of a new principle in this contrivance, the patentee does not say, as his specification merely describes his modes of construction, without claiming any particular part.

The principal objection to bedsteads of this description is the diffi-

culty of keeping them clean; there are in the different joints so many hiding places for vermin, as in this particular to set the utmost industry at defiance.

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5. For a *Plough;* William Black, Anne Arundel county, Maryland, October 4.

The improvement claimed is the fixing a cutter, or coulter, upon the front edge of the mould board, by means of screws and bolts. The front, or cutting edge of this appendage is to be in the form of a segment of a circle, convex outwards.

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6. For a *Machine for washing Gold out of sand and pounded ore;* Christopher Bechtler, Rutherford county, North Carolina, October 5. Issued under a special Act of Congress, the patentee being an alien.

An iron bowl is to receive the earth to be washed. This bowl is made with a flat bottom, and a vertical rim, presenting the form of a common seive. At one side of it there is a spout to allow water and sand to run off. The bowl is suspended from a piece of timber, like the dish of a pair of scales; the material to be washed is to be put into it, water also being allowed to run in to a proper height, the washing is to be effected by agitating the bowl in a particular way; the method of effecting this is the main point claimed, and is as follows:

Upon a flat table, or bench, there is to be fixed a band wheel, with a handle to turn it horizontally; the band from this wheel turns a small whirl just under the centre of the bowl, and a pin, placed a little out of the centre of the whirl projects up from it and passes into a hole under the centre of the basin; when turned, therefore, it keeps the bowl in agitation. Six bowls may be thus operated upon by one man, and the patentee says that one bowl will wash more than any other machine now in use, and that the most minute particles will be collected by it.

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7. For a *Machine for washing Gold out of sand and gravel;* Christopher Bechtler, Rutherford county, North Carolina, October 5. Issued under a special Act of Congress, the patentee being an alien.

This machine has a hopper at top into which the earth is to be thrown by one hand, whilst another is employed in turning a crank to keep the moving parts of the machine in operation; these consist of a pump, a seive, and a rocking trough. The pump is to raise water enough to supply the hopper; from this the earth and water fall down upon a seive which is kept in agitation, and placed in a sloping position, which causes the larger stones to roll clear off, whilst the gold, &c. passes through the seive. From the seive it passes on to a concave rocker, standing a little inclined, and having a ledge in front to detain the heavier pieces of gold. The lighter

particles flow with the water over the ledge, and fall upon a coarse cloth which is to collect them.

This machine, the patentee says, loses none of the metal, whilst all others lose from one-fourth to one-half.

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8. For an improvement in the *Guitar;* E. N. Scherr, city of Philadelphia, October 6.

The patentee calls this instrument the 'Harp Guitar,' and claims nothing peculiar in its construction, other than giving to it greater length than usual, so that its end may rest upon the floor, instead of being held in the hands or on the lap, as is usually done. In other respects it may assume all the varied forms of the guitar; "the improvement is, that the harp guitar is played resting on the floor."

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9. For a *Churn;* Amon Bailey, Poultney, Rutland county, Vermont, October 6.

A box is to be made in the form of the key stone of an arch, inverted. Through slots in the top of this pass the ends, or handles, of two vibrating dashers, which are to have slats upon their ends within the box; these slats are so arranged that they will pass each other. "The performer moves the handles of the dashers at the same time, in opposite directions, until the process is ended."

This improved churn will, we apprehend, exact a very awkward kind of action from the *performer.* There are many churns in which the cream is agitated much in the same way, but by more convenient appendages.

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10. For a *Machine for cleaning Chimneys;* Thomas Hinkley, Hallowell, Kennebeck county, Maine, October 7.

In its general construction this machine resembles many others which have been contrived for the same purpose, and some of which have answered very well in certain chimneys, although no one has yet been invented which can be used generally; nor, in the present state of affairs, is this to be anticipated. Chimneys are built according to the suggestions of the ignorance, intelligence, fancy, or caprice, of the bricklayer, without rule or plan; in the same flue they vary greatly in size, and are sometimes as tortuous as whim, accident, or genius could make them; and although fire or a climbing boy may be able to find their way along them, and operate upon all their sides and angles, it will require some universal genius to contrive a machine which shall be able so to do.

In the present machine there are four elastic arms, made of iron or steel, with brushes, or scrapers, as the case may be, attached to their ends, the arms being adjustable by means of segments of circles and thumb screws, placed near their junction at the lower part of the machine. When used a weight may be hooked on to the bottom, and a rope attached to the top of the machine.

The points claimed are "the adjusting arcs, with screws to regulate and fix the arms for the brushes and scrapers; the action of the

screws by which they press constantly against the side of the chimney; and the mode of adjusting the scrapers and brushes upon the arms, according to the dimensions of the chimney."

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11. For a mode of *Applying High Steam, and Hydrogen Gas, to aid in producing Combustion in the use of Anthracite Coal;* Paul Chase, city of New York, October 7.

The principal object aimed at by the patentee, is to supply a portion of hydrogen gas, obtained by the decomposition of water, to aid the combustion of anthracite in the furnaces of steam engines. In the arrangement described and figured, there are circular bellows, worked by a rod from the lever beam, to assist in supplying atmospheric air; this air is conducted by a pipe into a tube, or retort, of iron, which is placed across the fire place immediately under the bars of the grate. This tube, or retort, has holes in its upper side, to allow air and steam to escape into the furnace, between each of the grate bars. The steam which is to accompany the air is to be generated from water furnished through another tube connected with a reservoir of that fluid, the supply being kept up by a force pump. The proportion of water to that of air is to be as twenty to eighty.

When the air and water escape into the furnace, they do so, according to the statement of the patentee, in the form of "hydrogen gas, or high steam," which gas, or high steam, is to be taken up by the draft into the body of ignited coal, and cause a flame to extend throughout the fire-place and flues.

The patentee, it appears, filed a description of his invention in the patent office in March, 1828; the proposition to aid the combustion of anthracite by means of steam, is, however, of older date than this; yet we infer that this is the only thing intended to be patented. We say infer, because we are not clearly informed in any part of the specification, what is meant to be claimed as new. The drawing referred to in the description is very well executed, and the instrument has been carefully written, still it gives no instruction respecting several important points, and more particularly that of the claim.

There is mention made of water pans, which have rods of iron in them, to operate by the motion of a boat, and agitate the water in aid of the action of the above described tubes; this is all we hear respecting them.

As regards the theory, the truth of which is so generally taken for granted, that because the flame from burning fuel is expanded, or rendered diffusive by the action of steam, the water must be decomposed into its elements, oxygen and hydrogen, we have never admitted it as true. This is not the place to discuss such a subject, but it will be at once apparent to every one acquainted with chemistry, that such a decomposition of water must be simultaneously, or instantaneously, accompanied by its recomposition, and so far as the generation and extinction of heat are concerned, it would appear that one of these processes must exactly balance the other.

Water, when decomposed by passing over ignited charcoal, is converted into carbonic acid and hydrogen; if oxygen be supplied in

sufficient quantities by the admission of atmospheric air, this hydrogen will burn with flame, otherwise it will pass off with the products of combustion, without contributing in any degree to its intensity.

In the year 1818, Mr. Morey and Mr. John L. Sullivan each obtained patents for what they called "water burners;" we have not those patents now before us, but we recollect that water, or steam, was admitted among the flaming bituminous fuel, and that its effect was greatly to increase the volume of the flame; we then thought it did this by its expansive force only, and not by any actual increase of the quantity of flame. The method was not found to be productive of the anticipated economy, and the plan was consequently abandoned.

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12. For a *Machine for cutting and chiseling Stone;* Larman Z. Parke and Iram Brewster, the former of Delaware county, the latter of Schoharie county, New York, October 10.

In this machine rows of chisels are to act simultaneously upon a block of stone; an upright frame being made to sustain the apparatus. The block of stone to be cut is placed upon a carriage, or platform, which rests upon rollers, and which can be raised and lowered by screws, or other means. The chisels are retained in their proper positions by moveable racks, or rests, and each of them is raised from the stone by means of a spring acting in a notch at its upper end. Hammers, which strike upon the chisels, are to be lifted by cams placed upon a revolving shaft. The arrangement of the parts, and the modes of adjusting them, appear to be well imagined, and likely to answer the purpose intended.

The only claim made is to the privilege of varying the mode of construction and action, in certain particulars, from that designated in the description.

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13. For a *Machine for shaving the Hair from Deer Skins;* Rodolph Groning, city of New Orleans; an alien who has resided for two years in the United States, October 10.

Three rollers, each about three feet ten inches long, and three inches in diameter, are to be placed parallel to, and at a small distance from, each other in a suitable frame. The skins are to be passed up from below, between two of the rollers, and brought forward under a stationary knife of the length of the roller; a vibrating knife is at the same time made to operate, and by the action of the two, the hair is to be cut off. The claim is to the before described machine. The description, however, is not such as will enable a workman to construct it; the manner of fixing, and the action of the knives, not being made any more clear than they are in the above notice of them.

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14. For a *Machine for Spinning Hemp and Flax,* and other fibrous substances; Daniel Treadwell, Boston, Massachusetts, October 11.

The description of this machine extends to upwards of forty pages, and refers to sixteen figures, in which its respective parts are repre-

sented by drawings. From the nature of the case, it is not possible to present a good idea of the instrument without giving the whole of these. The subjoined extracts, however, are all that we can at present offer. The patentee observes, that "Before proceeding to the description, it will be useful to state, that spinning may be considered as consisting of two operations, first the drawing out of the filament to the required fineness, from a mass of the fibrous material, commonly in the state of roveing, or rolls; and second, the twisting of the filament so drawn, which completes the formation of the thread, or yarn. In some modes of spinning both of these operations are carried on at the same time in the same portion of the material: that is, the filament is elongated during the operation of twisting. In the invention herein described, the filament is drawn to the proper size before twisting it in any degree."

The patentee in his summary at the end of his specification, observes, that it has been necessary for him to describe a great many well known mechanical instruments, in order to show their application in this machine, without intending to advance any claim to the invention of them; and then proceeds to state, under four distinct heads, what he considers as original.

First. The combination of plates, points, pins, clearers, straps, &c. as described, which forms what is called the hatchel belt, and which, with its appendages, serves to draw out the material to be spun.

Second. A combination of instruments which constitute what is called the regulator, with the manner in which it is connected to, and operates with, the other parts.

Third. The combination of the comb, and apparatus by which it is operated upon, for the purposes described.

Fourth. A stopping guide and weight, by which the machine is brought to rest, wherever the unity of the yarn is destroyed.

These claims are guarded by stating that it is not intended to limit them to the precise forms represented, as these may, in every case, be varied, but to embrace that principle, or mode of operation, the character of which is pointed out in the particular description given.

From a very careful examination of the whole subject, as well as from direct information, and from confidence in the solid talents of the patentee, we are of opinion that this machine will prove to be one of great value.

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15. For an improvement in the *Manufacturing water proof Wool and Fur Caps;* Laban L. Macombier, Gardiner, Maine. First issued January 19th, 1831; surrendered and reissued October 11.

In the first patent it was stated that the improvement was for a "composition of matter used in stiffening fur hats and caps, by the use of Indian rubber, (elastic gum,) either in combination with gum shellac or alone." In the present it is said to be for a "mode of manufacturing caps of fur or wool, whereby they are rendered water proof,

and so elastic and pliable as to be folded in a small compass, and packed with clothes in a trunk, or elsewhere, after which they can be made to resume and keep their original shape, by using elastic gum, either alone, or in combination with gum shellac, and other resins."

The elastic gum is to be dissolved in turpentine, petrolium, or any suitable solvent. If shellac is used with it, this is to be dissolved in alcohol, and the two solutions mixed together, in the proportion of one part of the latter to about seven of the former. The solution is applied to the cap, which is then to be steamed until the solution is dry. The bodies of fur caps are then napped in the usual manner, coloured, and ironed. Those of felt are treated in the same way, with the exception of the nap.

The claim is to the application of elastic gum alone, or in combination, as above stated.

We have not seen the hats or caps as finished by Mr. Macombier, but learn that they fully justify the assertion of the patentee, that they bear folding up, and packing away, without injury; we should apprehend, however, that this character must more fully appertain to the cap, than to the hat.

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16. For a *New Portable Oven for Roasting and Baking;* William Goddard, Portsmouth, Rockingham county, New Hampshire, October 12.

This oven is formed of three separate sheets of iron or tin, and is in the form of a segment of a cylinder: in making it, sheet metal of suitable dimensions is bent round so as to form about three-fourths of a circle, the edges are then joined by a flat piece, which forms the bottom of the outer case. A second piece of sheet metal is then bent into the same form, but is to be the segment of a smaller circle than the first, so that when slipped into it, there will be the space of an inch between them; this when in its place, is to be rivetted to the bottom of the outer case. A plate is to be put on at the back end, and a rim fixed, enclosing the space between the two at the front. The space may be filled with charcoal, or other bad conductor, or may be occupied by air only. Through both these vessels two holes for flues are to be made at the top, one near to each end, and these are to lead to one common pipe, furnished with a damper; another hole is to be made for the escape of steam. Heat is to be applied by a round stove, or furnace, under the middle of the oven, a hole being perforated through the bottom sufficiently large in diameter to receive it; and a ring of cast, or of wrought, iron is rivetted to the bottom, in order to give the requisite strength to this opening.

A third box, made in the form of the other two, constitutes the oven proper. This is made exactly in the form of those already described, and is to be slipped into its place within them, leaving a space between it and the second box, and also between its back end and the first, which space is for the passage of smoke and heated air from the fire, around the oven, to the flues. The bottom of this is exposed to the action of the fire in consequence of the perforation

made through the outer box. When this last is secured in its place a door is to be fitted to it in the usual way.

There is no claim made to any part of this apparatus; the security of the patent, therefore, must depend upon the general novelty of its construction.

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17. For an improvement in the construction of *Steam Boilers;* Peter Cooper, city of New York, October 13.

This boiler is one of those which is so constructed as to expose a large surface to the action of heated air from the furnace, by dividing the inside into separate chambers, and by using tubes which communicate from one to the other. Its exterior form is that of a vertical cylinder, the outer case forming a jacket between which and the respective chambers, a portion of the draft may pass.

The furnace is a hollow drum, upon the flat bottom plate of which the fuel is placed; water is contained below, above, and around it. Air is supplied from the ash pit through numerous tubes secured at one end to the bottom of the cylindrical jacket, and at the other to the bottom of the furnace. From the top of the furnace pass up tubes, surrounded by water, and which open into a space under an upper drum, or chamber, containing water. Iron bolts pass from the bottom to the top of this upper chamber, to sustain the heads against the pressure of the steam; and there are similar bolts wherever else they may be thought necessary.

There are several particulars in the construction of this boiler which are claimed, the principal of which are the following:

The mode of constructing the bottom of the furnace of parallel plates, between which water is contained, and through which tubes pass to supply air to the fire; thus obviating the objection to the hollow bars, filled with water, which have been repeatedly tried, without success, as they are apt to burn off in consequence of the water being converted into vapour, an accident which the volume of water and the particular construction of this furnace will prevent.

The separating of the boiler into two parts, and the tubes in the lower one, are also claimed; likewise the outer covering, or jacket, so constructed that the smoke and dust are forced out in a downward direction under the bottom of the boiler; and finally "the combination and form here described, in principle, as well as in detail."

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18. For an improvement in the *Machine for Weighing Wagons, Carriages, Boats, and other bulky substances;* James Coulter, city of Philadelphia, October 14.

This machinery is certainly an improvement upon the kind *first* employed for the same purpose, but not upon several others of more modern invention, and in extensive use.

A platform is to be made of sufficient size to receive the load; which platform is to be suspended, like an ordinary scale, by rods rising from its four corners, and united at the top to a piece of strong timber pendant from the short arm of steelyards. From the long arm

of these steelyards a rod descends to other steelyards placed at a convenient height above the platform and furnished with its moveable weight in the ordinary way.

These are all the essential parts of the instrument, the novelty of which has eluded our view. The claim is simply "to the before described machine."

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19. For a *Rail-road Car, running on a single rail;* Charles F. Zimpel, city of New Orleans, Civil Engineer, late of the Prussian army, but for two years past a resident of the United States, October 15.

The single rail here proposed differs essentially from that patented by Palmer in England, upon which the car was to be suspended. The rail in the present instance is to rest upon the ground in the ordinary way. It does not appear to be the intention of the patentee to propose the employment of his single rail as a substitute for rail-roads for general traffic, but principally to be used on plantations, such as the sugar plantations of Louisiana, for carrying the cane to the sugar house, or the transportation of other articles to be conveyed a short distance only. The rail is to be entirely of timber, the whole width of which will be somewhat upwards of two feet.

There are to be two main wheels, one at each end of the car, which are to be about two feet in diameter, and one foot thick; it is proposed to make the face of each wheel concave for about six inches, leaving a tread of three inches at each edge. These wheels are to run in forks formed at the ends of the piece of timber which constitutes the perch, or beam, of the carriage. The body of the car is to hang on pivots at its upper edge, allowing it to vibrate laterally. For this purpose, posts rise vertically from each end of the perch, and receive the pivots by which the body is suspended.

The main part, or centre, of the rail, upon which the wheels run, must be somewhat more than a foot broad, and to each side of this main piece other rails are to be fastened, each six inches broad, and rising four inches above the main rail. The wheels therefore run in a trough four inches in depth. Upon the axles of the wheels, which are extended out at each side of them, there are safety wheels, of such diameter as not to touch the additional rails when the car is vertical, but to come into contact with them should it tilt on one side.

It is stated that the object of hanging the car upon pivots is to preserve the centre of gravity; but it is evident that if it swings either way it must carry the centre of gravity outwards, and tend the more to upset. There is no provision made for turning on a curve, and it would seem, therefore, that the road must, in all cases, be absolutely straight.

Although no claim is made, the novelty of the general arrangement appears to be sufficiently obvious.

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20. For an *Instrument for scraping Broom Corn;* Billy J. Billings, and John S. Billings, Gorham, Ontario county, New York, October 15.

An instrument much in the form of the common vertical reel, is made to revolve, carrying scrapers, or knives, at the ends of its arms, which scrapers, or knives, are to clear the broom corn from seed and dust. The corn is held in the hand, and laid upon the curved bed over which the scrapers revolve. The patentees state that by this machine they are enabled to do much more work than formerly, and that by its operation the seeds and dust are driven away from the workman.

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21. For *Tubular Essence Phials;* John Staniford, city of Boston, October 17.

Essence bottles, instead of being blown in the ordinary way, are to be made out of glass tubes; they will, consequently, be much more regular, neat and beautiful than usual. In this mode of making them the roughness upon the bottom is avoided, no punty being used in forming them; and the patentee states that they can be afforded at the same price which is paid for the inferior article.

Tubes of the proper size are to be divided into lengths sufficient to form two phials; each end is to be successively heated by a glass-blower's lamp, and the brim and neck shaped by pincers made for the purpose; the tube is then to be heated in the middle, separated, and the bottoms rendered perfectly flat and smooth by pressure against a piece of iron. In shaping the phial, an inclined plane is placed beside the lamp, upon which the tube is rolled.

There is no direct claim made, but the novelty, according to the statement of the patentee, appears to consist in the use of this inclined plane, and in the particular form given to the pincers to adapt them to the intended purpose.

The making of phials from glass tubes is not new; we have occasionally seen in use such as have been so made, and there is, probably, no one in the habit of blowing glass by means of the lamp, who has not made them for his own amusement, although they may not have been manufactured for the purpose of giving a general supply. The patentee might fairly claim whatever there is of novelty in his mode of procedure, but not the mere making of phials from tubes.

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22. For an improvement in the *Book Binder's Cutting Press;* Charles Stimpson, city of Boston, Massachusetts, October 17.

The improvements here claimed are two; first, the suspending of a board under the press, which shall serve as a gauge upon which the book to be cut may rest, instead of adjusting it as heretofore, by the aid of a mark made on the edges of the paper; there are to be three screws with nuts on them to support and adjust this board, or gauge; two of them descend from the right hand cheek, and one from the middle of the left, each of them passing through the board, and having nuts underneath it. The second improvement is the fixing of the two strips of wood, called the square, and cutting board, to the cheeks of the press, by means of screws, so formed that they can be

readily adapted to other squares and cutting boards, instead of replacing them every time a book is put into the press.

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23. For an improvement in the *Steam Engine;* Ithiel S. Richardson, Newmarket, Rockingham county, New Hampshire, October 17.

The improvement here proposed is as new as a great many others for which patents are taken; therefore, if not quite novel, it has fellows to keep it in countenance.

The proposition is to employ two or three cylinders with rods from their pistons operating upon the same shaft, the cranks making such angles with each other as shall correspond with their number, so that one or more may always be in action, and thus the necessity for a fly wheel be obviated.

If the plan itself is not new, at least some of the advantages which, according to the patentee, it is to produce, are truly so. One of these is that the steam will be constantly flowing into one or other of the cylinders, and thus all danger of explosion be avoided; another is the getting the same power with a diminished portion of fuel; the how or the why *we are not* told.

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24. For *Making Sleys and Reeds for Weaving;* Horace Holt, Rutland, Meigs county, Ohio, October 17.

The general construction of this engine, is that called the vibrating reed engine, but the feeding, instead of being regulated in the ordinary way by a spring, is effected by means of a screw having a cog wheel on its end, mashing into another cog wheel operating on the flyers. When the machine is to be drawn back, a spring box, forming the nut of the screw, is withdrawn, and the desired motion effected.

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25. For an improvement in *Pumps;* Noble Phelps, Turin, Lewis county, New York, October 20.

The improvement claimed, is in the piston, or bucket, and in the manner of placing the valves; the other parts, we are told, are to be made as usual. The piston is to be a leather bucket in the form of the letter V, into which the lower end of the piston rod is to pass, and to be securely nailed there. Two straps of leather nailed to the piston rod above the bucket, descend, and are attached to the latter, supporting it like a bail. There are, it seems, to be two valves below the bucket; one at the bottom of the chamber, and the other in its usual place. The use of these we know not, as the bucket, if it operate at all, must act as a valve, collapsing as it descends, and expanding in its ascent. The use of three valves in a common pump we are yet to learn, its disadvantages are easily shown. We are informed that in consequence of the use of this conical bucket "the working chamber may be enlarged to any convenient size, so as to convey a large quantity of water to the spout." We presume, however, that in this, as well as in other pumps, the power must be increased with the increase of size in the chamber; if this be not the

case we are ready to concede to the magnitude of the said improvement.

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26. For a *Parturient and Invalid Bedstead;* Joshua N. Robbins, Troy, Rensellaer county, New York, October 20.

This bedstead, "not known or used before" very much resembles several other invalid or hospital bedsteads, parts of it being made to raise by means of racks and pinions; and other contrivances being appended for the relief of those who require them. The patentee describes the whole without claiming any part, and although we might point out such minor differences between this and others as will be made by different workmen in structures which are essentially the same in principle, we should be unable to do more than this, and could not, therefore, supply the deficiency in the specification.

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27. For an improvement in *Paving Streets;* John L. Sullivan, city of New York, October 20.

The common effect of moisture, and more especially of frost, in loosening the earth under pavements made in the ordinary mode, are enumerated by the patentee, and the object which he proposes to accomplish, is to guard against these injurious effects, by laying the pavement in a cement which shall prevent water from insinuating itself between, and passing under the bricks or stones employed, and as the earth will thus be kept in a uniform state of dryness, that expansion which always accompanies freezing will be prevented, and the pavement remain permanent.

The ground is to be prepared by giving to its surface the proper form, and by consolidating it by means of rollers or rammers. Water, lime, or other impervious cement is then to be spread over the ground in a semi-fluid state; upon this the paving stones are to be laid as close to each other as possible; the interstices between them are then to be filled up by pouring upon them the same fluid cement, after which pulverized stones are to be strewed over and rolled down, the superfluous portion being scraped off as the work proceeds.

The principle, or mode of procedure, claimed, is the paving with common paving stones, or fragments of quarries, and setting them in with impervious cement. In the March number of this Journal for the year 1828, p. 179, there is a specification of an improved method of paving, for which a patent was granted in England, and which method is nearly identical with the preceding. The laying of stones in impervious cement, was practised by the ancients; the Roman ways may serve as examples; the practice has been followed in many parts of Italy, and in other countries, to the present day; a patent taken for doing so, must, therefore, be restricted in its object to the precise mode described by the patentee.

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28. For *Measuring for and Cutting Garments;* James Henderson and Cooper K. Watson, Zanesville, Muskingum county, Ohio, October 12.

If a judgment may be formed of the progress of any art by the *improvements* in it which are registered in the patent office, that of the tailor has not lagged behind in the grand race. It is not to the patent office alone, however, that we are indebted for a proof of this fact; no mean portion of the literature of the day has been devoted to the same subject, and we meet, almost everywhere, with pictorial illustrations of the variety of modes in which "nature's noblest work" may be embellished, or distorted, by the directors general of the fashionable world.

We have neither the theoretical nor the practical knowledge necessary to perceive the nice shades of difference in the various instruments contrived to assist the professional artist, and from fear of displaying our ignorance, as we have not had room for the whole, we have hitherto given but a brief and general view of them, a practice from which we shall not venture to depart on the present occasion.

The principal instrument now before us consists of a vertical measuring rod, sufficiently long to take the altitude of the tallest man. Upon this standard there are three sliding pieces with projecting arms, which are to be adjusted so as to mark the three cardinal points in the longitudinal admeasurement. To the uppermost of these slides, a scale of about three feet in length is attached; this scale slides in a groove in the standard, and is provided with graduated divisions, the correspondence of which with, or relationship to, other divisions upon the standard, indicate the manner in which the garment must be marked, before the shears are employed. These indications are properly explained in the specification, to which those interested are referred.

For the rotular and diagonal admeasurements, leather straps are employed, which are to be properly graduated. In the art of drafting the garment, a square is to be used, which square has graduations upon it corresponding with those of the general system, and adapting it to individuals in all their varying proportions.

The claims are to "the groove in the standard by which the length of the body, and a certain permanent point for the waist are ascertained; and to the straps by which the various curves and irregularities on the surface of the body are measured, and also the square described, and the manner of ascertaining the curve of the waist and spring of the skirt."

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29. For an improvement in the *Machine for breaking, dressing and cleaning of Hemp and Flax;* and softening and freeing the filaments entirely of shivers; La Fayette Tibbots, New Glasgow, Amherst county, Virginia, October 22.

Mr. Tibbetts refers to a machine for the same purpose, patented by him on the first of August, 1829, as the foundation upon which rest the improvements now proposed; that is, upon what he calls the "arch principle." His improvement consists, he tells us, in re-acting powers, which drive the gearing of his rollers thirteen feet, more or less, forward; which power returns back again to the point whence

it started, like the vibration of a pendulum. This gearing is so constructed, however, as to cause the action of the breaking rollers to be greater in the forward, than in the backward direction; and the claims made are to "the principle of the vibrating or re-acting powers, which revolves the fluted rollers as far forward as back; together with the construction of the power gearing, the position of the parts, and the manner of operation of the instruments generally; also, the re-action or vibration of said rollers in their revolutions to operate further forwards than backwards, in order to gain from three to twelve inches in each vibration." The principle of vibration is also claimed, without restriction to any particular form of gearing, or instruments for effecting it.

Many patents have been taken for machines for breaking hemp and flax, and much money has been unfortunately spent in their erection, whilst but few, if any, of them have continued in use sufficiently long to test their adaptation to the purposes intended, and to correct those imperfections incident to a new machine. For the cause of this we must inquire further than into the mere construction of the machines themselves. The culture of the raw material, with us, may be said to have hitherto been a failure; either from soil, climate, or inexperience in management, our hemp is inferior to that imported from Russia, and whilst this is the case, neither our national or mercantile marine will be trusted to cables, hawsers, or sails, manufactured from it. For ourselves, we are equally unwilling and unable to believe, that in our widely extended country, a country affording almost every kind of soil, and variety of climate, a plant which grows so luxuriantly in many situations, must necessarily be inferior in those properties which give to it its greatest value; we will, therefore, still indulge the hope, that perseverance, and consequent experience, will yet suffice to establish an article so necessary both in the arts of peace and war, as one of our staples.

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30. For an improvement in the mode of *Thrashing, cleaning, and grinding of Wheat* and other grain; La Fayette Tibbotts, New Glasgow, Amherst county, Virginia, October 22.

The description in both this and the preceding patent, is, to us, very defective in point of clearness. We shall not, therefore, attempt to designate the particular improvements made. In the present machinery there are several things claimed, but in that broad way which does not very clearly distinguish the same from all other similar things before known or used. This the patentee calls a portable or local mill, and of it he claims *the principle.* "Also the principle of the bridge tree and rattle staff springs, and the bridge tree rod and rattle staff hollow screw for regulating the mill, together with the application of the bolt to receive the meal from the mouth of the spout," &c.

When Oliver Evans introduced his improvements in mills, such as the elevators, hopper-boy, &c., their nature and use were of easy designation; we saw clearly in what they consisted, and could easily answer the questions, what are they? and what are they for? the pre-

sent, however, are more recondite, and we must refer inquirers to the inventor.

The thrashing machine, included in this patent, may be driven by the same power as that which drives the mill; the latter being "local," (*locomotive*, we suppose,) may be removed, and the former applied. The claim in the thrashing part is to "the principle of double action in thrashing wheat and other grain by beaters, rollers, &c. &c.; or by any two or more revolving motions, one above the other, so as to let the straw containing the grain pass between said motions of beaters, &c. The said principle of revolving beaters, *above* as well as *below*, all turning inward, and drawing the grain in the straw through between them, as fast as the feeding rollers deliver the same, is what I claim under the principle of double action, by pairs of beaters or otherwise."

The *principle* spoken of as applied to the thrashing machine, is the placing around a large cylinder, three or more smaller ones, in the manner of the small carding rollers in a carding machine.

Without attempting to touch the question of novelty; there appears to us to be two objections against the specification of this patent, *first*, the things claimed are not presented with sufficient distinctness; and *secondly*, it is not a patent for *a machine*, but for two separate machines. There is no more necessary connexion between the thrashing machine and the mill, than there is between the mill and a baker's oven, yet it would appear rather strange to take out *one* patent "for a mill for grinding meal, and an oven in which the same may be baked into bread."

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31. For an improvement in the *Construction of Chimneys;* Henry Antes, Harrisburgh, Dauphin county, Pennsylvania, October 24.

A single flue is to be carried up from the cellar to the top of the chimney, and into this flue a throat passes from every fire place. These fire places may stand back to back, so that six fire places, on three floors, may open into the same flue, which, in this case, we are told, may be three feet wide, by one foot two inches in the clear. Air flues, to supply a draught from without the room, are to pass down the jambs, and open into the fire places. The ashes are to be conducted into the main flue, through openings made for that purpose, and are to fall into an ash pit in the cellar, where there is a man-hole, closed by a door. Shutters, or registers, are to be applied to each of the throats of the fire places.

The claim "is the improvement before described; particularly in proportioning the inlets to the capacity or area of the flue of the chimney, and in requiring only one flue for any number of fire places in the same stack."

We apprehend that separate flues to each fire place, would be an *improvement* upon this plan, although, in certain cases, we have known one common flue to answer well for six furnaces. We know of a chimney, built nearly forty years since, for a casting shop for a brass

founder, which consisted of one wide flue in the wall, into which six furnaces opened, and we also know that the draught was perfectly good, better, in fact, than in ordinary furnaces, whenever all the furnaces were in blast; but when the number was diminished, the air in the large flue was not sufficiently rarified, and the draft was proportionally decreased. Such will be the case with the chimnies in question; if fires are lighted in every fire place, it may do well enough; but, if otherwise, one of "the miseries of human life," a smoky chimney, will have to be encountered. The throats of two fire places opening against each other, as shown in the drawing, is a part of the plan which will be found not to answer in practice.

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32. For a *Thrashing Machine:* William Prescott, Pottsville, Schuylkill county, Pennsylvania, October 25.

We have here a thrashing machine which affords us some relief from that eternal round to which the whirling cylinders of most others are to be subjected. We in this case return, it is true, to something like the older thrashing machines, those which existed before the first Scotch cylinder machine was made.

By the present machine the thrashing is to be performed on the barn floor, by rows of flails, or beaters, acting like those for batting wool and cotton. The four legs of the frame have grooved rollers on them, which run upon parallel bars, forming a rail-way along which the machine may be shifted, to prevent the continuance of the blows on the same spot. A shaft carrying a fly wheel, is to be turned by a crank; this, by means of two other cranks and pitmen, gives a partial rotary motion to rollers working on gudgeons in the frame, on either side of the machine. These rollers sustain rows of flails or beaters of wood, which are connected to them by elastic bars, serving as springs.

When horse, or other sufficient power is used, the number of flails, rollers and cranks may be increased.

The claim is to "the before described machine, for thrashing grain by means of vibrating flails."

The "before described machine," although differing something in arrangement from others acting upon the same principle, is so similar to them, that we think it should have been said in what part the improvement resided, we also think that this might have been done.

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33. For a *Machine for Hulling Clover;* Pearson Reading, Trenton, New Jersey, October 25.

There is to be a revolving cylinder set with iron teeth, and rows of iron plates; the cylinder may be about three feet long; this is to revolve within a barrel, or casing, made of staves and set with iron teeth. The casing is to be a little conical, allowing more space at the feeding than at the delivering end. The seed is to be put into a hopper, and forced down on to the cleaning roller by a follower. We are told, that by removing the casing, and supplying a hollow segment, set with teeth, it may be converted into a thrashing machine.

Whether this is intended to make a part of the patent, or in what the peculiar merits of the machine consist, we are not informed, as there is no claim made.

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34. For a *Machine for Planing Plank and Boards;* Ebenezer Lane, Cincinnati, Hamilton county, Ohio, October 26.

Plane irons, of the ordinary kind, are to be placed in a row, about two inches apart, when the irons are two and a half inches wide. The stock in which they are fixed is to be of cast iron, and the irons must stand the reverse way from what they do in a common plane, their cutting edges being towards one side of the stock, all the irons in it lying in the same plane. Another stock is to be prepared to stand behind the former, with the irons placed between the spaces of the first, and in this way several stocks may be arranged. These are then to be fixed in a strong wooden or iron frame, one behind the other. This frame may be stationary, and a carriage, or bench, running upon wheels, and bearing the stuff to be planed, may then be forced under it by any adequate power; or the plank may be stationary, and the frame, with the cutting irons, carried over it.

The claim is to the frame containing the plane irons, and to their arrangement.

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35. For a *Thrashing Machine;* Ebenezer Gordon, and David T. Gordon, Oswego county, New York, October 27.

We have nothing very particular to say respecting this machine, as its history has already been given in the detailed accounts of some of its predecessors. It consists of the ordinary cylinder and concave set with teeth. The specification enters into a very minute description of its respective parts, and contains every thing relating to it with the exception of that which is of some importance, to the patentee at least, namely, the designation of those parts which are new, and upon which the claim to a patent depends; to have pointed out these, however, might possibly have "puzzled a Philadelphia lawyer."

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36. For a *Chimney Valve;* John Baker, Lancaster, Lancaster county, Pennsylvania, October 28.

We may next look to see a patent taken for handkerchiefs to be worn in the pocket; for although they are somewhat more common than valves in chimneys, their claim to novelty is about equal.

The valve proposed, is a shutter of cast or wrought iron, fitting in, and hinged to a frame in the chimney, with a segment rack to support it at any desired height. Having a wife and children, and gray hairs which tell of olden time, we have nothing to fear from the averment, that when we first saw such valves in chimneys, nearly half a century ago, they were no novelties.

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37. For additions and improvements in a machine patented on the 4th of November, 1830, called a *Machine for Scraping the Flesh and Hair from Hides and Skins*, and for all other scrap-

ing necessary in tanning and currying leather; Thomas Williams, Rochester, Monroe county, New York, October 31.

For the general construction and use of this machine, we must refer to the specification, p. 173, vol. VII. The improvement now claimed is the application of a cylinder with knives, placed either straight along it, or obliquely; (the oblique position favouring the spreading of the skins,) with a concave against which the roller acts, and which is borne up against it by means of spiral springs. The various parts for giving motion to the machinery are also claimed, as "the application of the carriage and its appendages, and of the crank, levers, cog wheel and pulleys, pinion, and cylinders, to the purposes for which they are to be used in the said machine."

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38. For an improvement in the *Construction of Steam Boilers, to regulate the height of Water within them;* Dummer M. Hooper, New Albany, Floyd county, Indiana, October 31.

A float, made of any suitable materials, such as wood, cork, or metal, is placed within the boiler, and is to rise and fall with the water in it. A vertical rod attached to the float, slides through guide pieces, which retain it in its proper position. The upper end of the rod is made conical, that it may operate as a valve, the seat of which is the open end of a steam tube, which passes through the top of the boiler; when the float is borne up by the water, the valve comes in contact with the lower end of this pipe, and closes it; when the float descends, by the diminution of the water, the valve is to open, and allow steam to escape through the aforesaid tube. This tube does not lead to the cylinder of the main engine, but is intended to set a separate small engine at work, made expressly for the purpose of operating upon supply pumps to fill the boiler.

The inventor says that "this mode of supplying boilers with water by an engine expressly for the purpose, which is put in motion or stopped by means of a float within the boiler, which I call an 'improved self-regulator,' is what I claim as my invention."

The necessity of employing two engines in the place of one, would, alone, present a formidable difficulty in the way of introducing this plan, were there no other objection to it; should it appear, however, that if adopted it would not answer the intended purpose, this must be fatal to it, and such we unhesitatingly say would be the fact. The motion of the water in the boiler would keep the valve in a state of constant agitation, whenever it descended near to the point at which the valve should open; nor would the steam ever pass off in a stream sufficient to set the engine at work which is to operate upon the force pumps; and were it possible to set it in action, it must stop the moment the valve closed, and thus continue perpetually starting and stopping. Every practical engineer will, we apprehend, concur with us in pronouncing the scheme altogether fanciful.

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39. For an improvement in *Making Glass Knobs;* Spencer

Richards, Cambridge, Middlesex county, Massachusetts, October 31.

The improvement here patented is the insertion of a brass nut in the body of the knob, with a hole leading to it from the lower part. Into this nut a male screw may afterwards be passed, by which the knob may be fixed to drawers or shutters without the use of a tapped nut. In the common way of making knobs, a hole is left entirely through them, and the shank by which they are fastened, has its head on the top of the knob; by the present method, the top of the knob is whole, the perforation extending no further than to allow the screw shank to pass into the nut.

Pressed knobs have been frequently made with screw shanks imbedded in them, but they are apt to break the knob, an objection which will probably be removed, or much lessened, by inserting them into a nut in the manner proposed.

ENGLISH PATENTS.

To John Burgis, *ornamental paper manufacturer, for his new invented method, or methods, of gilding, or silvering, certain woven fabrics in burnished, or burnished and dead, or matted gold or silver, and which said fabrics may be used as gold or silver, and lace borderings, and for other purposes. Sealed 5th February,* 1829.

The very great expense of gold and silver lace, has induced the patentee to invent a simple and cheap mode of manufacturing an imitation of that costly material, which he proposes to employ in decorating curtains, chairs, and other articles of household furniture. The material to be employed is fine cotton or other cloth, upon which a coating of gold or silver leaf is to be laid, by the ordinary process of gilding and silvering. The cloth is then to be cut into narrow strips, and wound round cords to resemble cords of gold, which cords may then be plaited or otherwise woven into lace of various kinds. The cloth about to be operated upon, is first dyed, (if for gold, of an orange or yellow colour.) It is then to be stretched out upon a flat surface, and covered with a coating of size, made of parchment shavings, in the same way that gilder's size is commonly made. When dry, the reverse side of the cloth is to be sized in the same way.

After this preparation, two or three coatings of the material called gold size is to be laid upon that surface of the cloth which is intended to be guilt; this size being made of gelatin, with pipe clay and ochre, or other yellow colour. When the materials have become perfectly dry and hard, the surface is to be polished smooth, and all hairs or small pieces of grit removed.

The cloth being tightly distended upon a flat surface, is now to be sponged over with water, and then the leaf gold laid on smoothly

with a gilder's camel hair brush, taking care that all the fractured parts of the gold leaf are afterwards carefully covered with fresh pieces of gold leaf, so as to leave no parts of the surface ungilt.

When the gilding has become perfectly dry and hard, the cloth may be passed over a roller, and brushed, for the purpose of burnishing its surface; and if it has been gilt on both sides, that part of the cloth which is undermost should be carefully covered with paper, to protect it from injury while under the operation of the burnishing brush. But when dead gold is required, then the burnishing brushes may be dispensed with.

The cloth having been thus gilt, is then to be cut into strips of any required width, in a machine, with knives or shears, placed at suitable distances, in order that the strips may be perfectly parallel. These strips are then to be wound or bound round cords of suitable thicknesses, the cords having been previously dyed of an orange or yellow colour; and the cords, after having been so covered with the gilt cloth, may be twisted together to represent bullion, or in any other way plaited or woven in the manner that gold lace is commonly made. Precisely the same operations are to be performed in the preparation of silver lace.

This artificial gold or silver lace may be applied as cording or bindings for the edges of chairs, sofas, &c. or for the fringe of curtains and other drapery. [*Lond. Jour.*

To THOMAS, WILLIAM, *and* JOHN POWELL, *of the city of Bristol, glass merchants and stoneware manufacturers, for their invention of certain improvements in the process and machinery, or apparatus, for forming, making, or producing moulds or vessels for refining sugar; and in the application of materials hitherto unused in making the said moulds. Sealed 17th May,* 1828.

THE patentees propose to make the conical moulds, or vessels, in which refined or loaf sugar is moulded from stoneware clay, and to glaze them both within and without.

In the first instance, the stone ware clay is to be prepared in the usual manner, and is then to be put under a press, for the purpose of bringing it into a sufficiently stiff and compact consistency. In the bottom of the vessel in which the clay is pressed, a mould is placed, consisting of a flat board, with a broad conical aperture cut out of its centre. In this aperture of the board the clay is to be shaped which is to form the vessel.

As the board lays flat under the press, the clay will necessarily be forced into the recess, or aperture; which being done, it is then cut off level from the clay which is above it, by passing a wire or string, or thin cutting blade over the surface of the board, which leaves the portion of clay thus moulded in a thin slab of a broad conical form.

This slab of clay, while in its plastic state, is then placed round a conical block, so as to cover the block perfectly, and any small de-

fects which may be left at the junctions of the edges of the slab, are to be made up with small portions of clay, laid on with a spatula or palette knife.

The block is now set in a convenient situation, where the coating of clay may be dried by the air; and when it has become completely dry, the block is fixed upon a rotary spindle passed through its axis, and the outside of the clay vessel is turned perfectly smooth in the same way as stoneware articles are usually made.

The shell of clay being then slipped off its block, will be found to be an accurately formed conical vessel, having a small hole in its apex, and suited for the purpose of a sugar mould, perfectly smooth both within and without.

Any number of these conical vessels may then be placed upon their bases side by side, in an oven, for the purpose of being baked, and they are to be glazed within and without by salt, as clay stoneware is usually glazed. [*Lond. Jour.*

To JOSEPH CLISILD DANIELL, *Clothier, for certain improvements applicable to the manufacturing and preparing of Woollen Cloths. Sealed 5th August,* 1828.

THERE are two objects proposed under this patent: the first is designed to preserve a uniform tension in the warp threads of a cloth loom; the second, to give additional force to the beaters of a stock for fulling cloth.

In the first instance, the loom is not intended to be altered in its general construction from ordinary looms for weaving cloth, but there is affixed to the end of the warp roller a pulley, over which a weighted cord is passed for the purpose of drawing the warp tight, and at the same time allowing it to be given out as the batten beats up the work. A similar pulley is also attached to the end of the work roller, with a weighted cord passed over it in the opposite direction to the former, in order to draw up the work. Hence the warp threads are always kept at a uniform tension, and when any additional force is exerted as in beating up, a small portion of the warp only is given out, by the roller slipping round under the weighted cord.

The second feature of the invention applicable to fulling stocks, is designed to supersede the present mode of allowing the beaters to fall from a height by their own gravity, and to effect the beating and milling of the cloth by their descent. Instead of this it is proposed to raise the beaters but a short distance up from the cloth in the cell of the stock, and to give forcible effect to their descent by means of powerful springs acting at the back of the arms of the beaters.

The adaptation of springs to the backs of the beaters, for the purpose above stated, may be effected in various ways, and by several kinds of springs, all of which the patentee claims as coming under

his invention, and the advantages anticipated are that considerable time may be saved in the performance of the fulling or milling process, by shortening the stroke of the beaters, which will allow of a much more frequent repetition of the blows than when the beaters are allowed to fall from a height; and the power of the spring upon the improved plan may be made to give an equally effective blow to that produced in the ordinary stock by the descent of the beaters from gravitation. [*Lond. Jour.*

Specification of the patent granted to ROBERT STEPHENSON, *Engineer, for an improvement in the Axles and parts which form the bearings at the centre of Wheels for Carriages which are to travel upon edge Rail-ways. Dated March* 11, 1831.

To all whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Robert Stephenson, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, is particularly described and ascertained as follows, (that is to say):—

My improvement in the axles and parts which form the bearings at the centres of the wheels for carriages which are to travel upon edge rail-ways, consists in fixing two of the said carriage wheels fast upon the extreme ends of a long, hollow or tubular axis, within which a solid central axis is inserted, extending through all the length of the hollow, and projecting out sufficiently beyond each of the hollow axes to enable the weight of the carriage to be supported upon the projecting ends of the solid central axis, around which the hollow axis turns, together with the two wheels which are both fastened, (as aforesaid,) upon the ends of the hollow axis.

In the carriages now used upon the Manchester and Liverpool Rail-way, each pair of wheels are fixed fast on the two opposite ends of a long solid axis, which revolves with the wheels, and the two extremities of the solid axis which project out through the centres of the wheels, are formed into pivots or gudgeons, and are received in suitable sockets, whereon the weight of the carriage is borne by the hollows or concavities of those sockets pressing downwards on the pivots. In travelling with great rapidity, the said pivots require a copious supply of oil, much of which is wasted, because the hollows or concavities of the sockets, (which do not revolve,) are inverted, in order that they may bear downwards upon the upper parts of the circumferences of the revolving pivots of the axis; consequently, the oil has a tendency to run down and escape from the places of bearing where it is wanted. According to my improvement, it is the central axis which does not revolve; and it is the lower parts of the circumference thereof which apply and bear downwards within the hollows

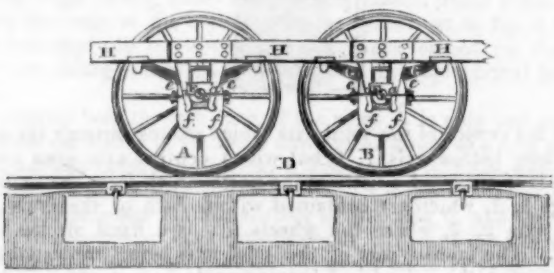
or concavities of the hollow axis, which does revolve around that central axis; consequently, the oil has a tendency to run down into the places of bearing where it is wanted; the action thereof being (in that respect,) the same as in the axles and boxes of common coach wheels, wherein the axle does not turn round, but the box in the centre of the wheel turns round about the axle.

For travelling on edge rail-ways the wheels on the opposite sides of the carriage require to be firmly united, so that they will turn round together in pairs, in order to prevent one wheel from advancing either faster or slower along one rail than the other wheel advances along the other rail. On the common plan of coach axles and boxes, the wheels of each pair being quite independent one of another, one wheel can turn round without the other wheel; and hence such axles and boxes are unsuitable for the wheels of carriages which are to travel upon edge rail-ways; and hence the mode above stated has been introduced; videlicit, that of fixing each pair of wheels upon a solid axis, which turns round with them, and compels them both to go together: according to my improvement of fixing the two wheels upon the extreme ends of a long hollow or tubular axis, as aforesaid, the pair of wheels are firmly united together, so that one wheel cannot advance more along one edge rail, than the other wheel does along the other rail; and that circumstance, (which is an important condition for travelling with safety and rapidity on edge rail-ways) is combined with the advantage of the ordinary coach wheel axles, in respect to their supply of oil; videlicit, that the bearing of the solid axis which does not turn round, presses downwards into the hollows or concavities of the hollow sockets, which turn round with the wheels, giving the oil a tendency to insinuate itself between the bearing surfaces.

Description of the drawing.

The drawing hereunto annexed, represents so much of a carriage which is to travel upon an edge rail-way, as is necessary to explain my improvement. Fig. 1 is a lateral elevation of a four wheeled

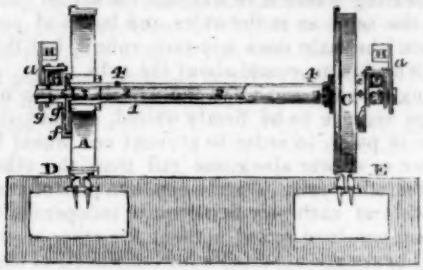
Fig. 1.



carriage, suitable for conveying goods on an edge rail-way, showing the two wheels A B, which follow each other along the same rail D of

the rail-way. Fig. 2 is a transverse section, answering to fig. 1, and

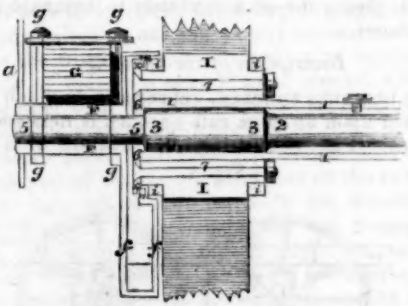
Fig. 2.



showing one of the pairs of wheels A C, which are at opposite sides of the carriage; one running on one rail D, and the other on rail E.

The pair of wheels must be united together, as before mentioned, and that is done by means of the long hollow or tubular axis 1, 1, the two ends of which are inserted and firmly fastened into the central holes of the two wheels A C, so as to keep them at the proper distance apart, to suit the space between the rails D E, and to keep them firmly vertical when they turn round. One of the wheels A is represented in section, as if it were cut through the centre by a vertical plane, to expose the interior parts, and that section is repeated on a larger scale in fig. 3. To explain the structure of the parts,

Fig. 3.

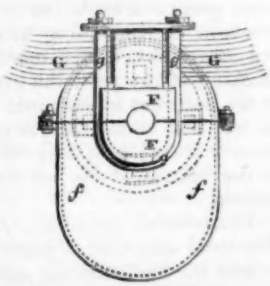


2, 2, is the centre of the solid axis which passes through the interior of the long hollow axis 1, 1, but which central axis does not turn round. It is enlarged a little at the parts which form the cylindrical bearings 3, 3, which are contained within each of the ends of the hollow axis 2, 2, where the wheels A C are fixed on the outside thereof. The middle part of the solid axis being rather smaller in diameter than the cylindrical bearing parts 3, 3, a space is left vacant all round the solid axis, within the hollow axis, to contain a stock of oil. When that stock requires to be renewed, a supply of

fresh oil is poured into the vacant space through two holes at 4, 4, which are then stopped very tight by screw plugs. When the carriage is in use, the oil makes its way from the middle part of the hollow axis, towards each end thereof, where the bearings are, and thereby the bearing surfaces are kept constantly supplied with oil. The ends of the central axis, which project out beyond the ends of the hollow axis, are also smaller in diameter than the cylindrical bearing parts 3, 3, as shown at 5, fig. 3.

The weight of the carriage is supported upon those projecting ends 5, each of which is for that purpose received in a socket F F, made in two halves screwed together, as shown in fig. 4 and in fig. 2, by four small bolts, *e*, *e*, and also by the two staple bolts *g*, *g*, which fasten the springs G down across the upper flat sides of the socket F; and the pressure of all those screws binding the two halves of the said socket F firmly together, around the end 5 of the solid axis, fastens the socket to the axis. The outer end of the socket F is fitted into a vertical groove, formed in the space between the two prongs *a*, *a*, of a forked plate of iron, which is screwed to the horizontal side rail H of the carriage, as shown in fig. 1, and projects downwards therefrom. The ends of the springs G apply to the underside of the side rails H, and bear the weight of the carriage; the middle parts of the springs being borne upon the socket F, to which they are fastened, as before stated: and when the springs bend, (by the jolting motion of the carriage in passing over the joinings of the rails, or other uneven places,) the sockets F rise and fall in their vertical grooves *a*, *a*. To confine the hollow axis with the wheels from having any unnecessary end play on the solid axis, circular plates or rings of metal are fastened one against each end of the hollow axis, being bolted fast to the flat surfaces of central bosses or naves I of the wheels; and those rings having small circular projections, which enter a little way into the ends of the hollow axis, (as shown at 6, fig. 3,) those projections apply to the shoulders, which are formed on the solid axis by the enlargements 3, 3, which form the cylindrical bearings thereof.

Fig. 4.



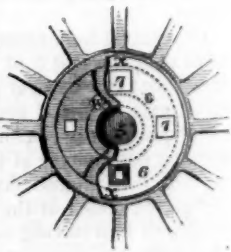
The central hole through each of the rings 6, is only just so much larger than the end 5 of the solid axis, as to allow of a free turning motion; but the central projection which enters into the end of the hollow axis, is fitted very tight therein. A large washer of leather is interposed between the flat surface of the ring 6, and the corresponding flat surface of the central boss or nave I of the wheel; and the ring 6 is bound fast thereto by screw bolts 7, 7, which pass through the boss I of the wheel, having their heads countersunk into the ring 6, and having nuts screwed on their opposite ends, which project through the boss of the wheel.

The ring 6, with the leather washer, prevents any oil getting out, except that which makes its way between the central hole of the ring 6, and the end of 5 of the axis; and in order that the oil which so makes its way may not drip away or run down the arms of the wheel, and get to the rails, or be lost, a hollow oil box *f f*, is provided to receive and save the oil which escapes. The said box is cast in the same two pieces with the socket F, before described as being in two halves; when they are put together, the oil box *f f* clasps around the outer end of the nave 1 of the wheel; and the circular rim *x* of the ring 6 projects beyond the flat surface of the nave 1, against which it is fastened by the bolts as aforesaid; and the part *x* so projecting, being opposite to the flat surface of one of the circular hoops *i*, (by which the nave is bound and strengthened,) forms a circular groove around the circumference of the nave 1, into which groove a corresponding interior rim *m*, *m*, of the oil box, projects and interlocks, in the manner shown in the section; and without touching at any part, the interlocking prevents the escape of the oil, or the entrance of dust into the oil box; but all the oil which makes its way out of the hollow axis will be caught in the oil box, from whence it may be drawn off through a suitable plug hole or tap cock at the bottom of the oil box, when a quantity has accumulated therein.

The form of the oil box *f f* is fully explained by figs. 2, 3 and 4. The solid axis 2, 2, is made of wrought iron of competent strength to bear the load that the carriage is to convey. The dimensions represented in the drawing are adapted for a carriage of four tons weight when loaded, (being one ton bearing upon each wheel.) Figs. 1 and 2 are drawn to a scale of one-eighth of the real size; and figs. 3, 4 and 5, are one-half of the real size.

The carriage is represented with wheels three feet diameter, made of cast iron in one piece, and surrounded with wrought iron tires to run upon the rails; also with wrought iron hoops surrounding the projecting ends of the nave, to prevent splitting. The wrought iron tires and hoops are applied in the usual manner when hot, that they may shrink on the cast iron in cooling, and bind the same very tight; the outsides of the tires are turned true, and the central holes through the naves are bored truly cylindrical. The ends of the hollow centre axis are turned true on the outsides, to fit tight into the holes through the wheels; and when inserted they are secured by driving in a key, which is fitted into a hole previously cut in the joint, so that one half of the thickness of the key lodges in the cast iron nave, and the other half in the wrought iron hollow axis—see w, fig. 5. The extreme ends of the hollow axis conform with the flat surfaces of the naves of the wheels, in order that the flat surfaces of the rings 6, with their leather washers, may apply to both.

Fig. 5.



The hollow axis is made of wrought iron,

welded in the manner of gun barrels; an extra thickness is given at each end, where it is to be fitted into the wheels. The inside of the hollow is bored out truly cylindrical at each end, where the bearing parts, 3 3, of the solid axis, are to fit into it; those parts are turned truly cylindrical, and may be case hardened, as well as the interior of the hollow axis at the bearing parts, and also the projecting central parts of the ring 6. Note.—These projecting parts enter so far into the hollow axle as to leave very small vacant spaces between them and the shoulders of the central axis, and to allow about a quarter of an inch end play to the wheels along the solid axis.

Many of the parts hereinbefore described, admit of being differently constructed, without any departure from my invention. Wheels of wood, with cast iron naves, may be substituted for those represented in the drawing. The hollow axis may be made of cast iron, if a suitable increase of metal is given to make up the same strength. The ends where the bearing parts of the solid axis are to fit into the ends of the hollow axis, may be lined with brass, or with bell metal, inserted and fixed in. The ends of the solid axis may be fitted into its socket *v*, so as to be at liberty to turn freely round therein, instead of being held fast, as before described. The use of that will be that the axle may turn round with the wheels, in case it has been neglected to give a due supply of oil to the hollow axis, before setting out on a journey; and that in consequence the fitting parts thereof become bound together during a journey. A narrow groove may be cut in the cylindrical surface of each of the bearing parts of the solid axis, winding spirally round the same, in order to assist in conveying the oil to all parts of the length of the bearing.

Having now described my said invention, I do hereby declare, that what I claim as my improvement in the axles and parts which form the bearings at the centres of wheels for carriages which are to travel upon edge rail-ways, is the combination hereinbefore described, of those parts which are marked in the drawing, with numeral characters for reference in the foregoing description. That combination being made for the purpose of causing the bearings of the solid axis, (which does not turn round,) to press downwards into the concavities of the hollow axis, which does turn round with the wheels; and which hollow axis connects the two wheels together, so that one cannot turn round without the other. And I make no claim to the said improvement, except in its application to carriages which are to travel upon edge rail-ways.

In witness whereof, &c. [*Rep. Pat. Inv.*

Specification of a patent granted to George Stephenson, *of Liverpool, engineer, for an improved mode of making wheels for Rail-way carriages. Dated April* 30, 1831.

To all whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said George Stephen-

son, do hereby declare, that my said invention is described and ascertained in manner following, (that is to say):—

My said improved mode of making wheels for rail-way carriages, consists in forming the same with a suitable number of hollow tubes of thin wrought iron to form the spokes, arms, or radii of such wheels; which tubes after being prepared at their ends (in the manner hereinafter described,) with borax, to serve as a flux to the wrought iron, are laid in proper radiating directions, into a mould formed of sand, in a suitable manner, to receive melted cast iron; which cast iron being poured into the central cavity of the said sand mould, will surround and attach to the inner ends of all the wrought iron tubular spokes, at the parts where the said preparation of borax has been previously applied thereto, and thus a nave or centre piece of cast iron, will be formed for the weel; and also melted cast iron being poured into the other cavities of the said sand mould, will surround, and attach to the outer ends of the same spokes, at the parts previously prepared with borax; and thus the circular rim or felly of the wheel will be formed in cast iron: and that felly is afterwards to be surrounded with a strong wrought iron tire or hoop which is applied when hot, around the cold cast iron, so that it may shrink or contract thereon in cooling, in order to firmly unite and bind all the parts of the wheel together: and lastly, the outer edge of the said tire must be suitably turned and formed to run on the rail-way.

And whereas, wheels for rail-way carriages have been commonly made under a patent granted to William Losh and myself, in the year 1816, with spokes of wrought iron of various forms, (but not hollow tubes,) and with cast iron naves and rims formed and united to the ends of the said wrought iron spokes, by running melted cast iron into suitable moulds formed of sand, the said cast iron surrounding and attaching to the ends of the said wrought iron arms, but without any previous preparation for those ends, with borax to serve as a flux; and also the wheels as formed, have of late been hooped with wrought iron tire.

I do hereby declare, that I confine my claim of invention under the present patent, (for my improved mode of making such wheels for rail-way carriages,) to the substitution of hollow tubes of wrought iron for spokes, in lieu of the solid bars of wrought iron heretofore used for spokes, and to the application of a preparation of borax as a flux, (in the manner hereinafter described,) to the ends of such hollow tubular spokes, previously to placing them in the sand mould, and to running the cast iron round them. The said hollow tubes for spokes, at the same time that they are stronger in proportion to their weight than solid bars for spokes, will hold more securely in the cast iron of the nave, and of the rim, because the cast iron running into the hollows at the ends of the tubes, as well as around the outsides of the tubes, obtains a much greater surface of contact with the wrought iron, than heretofore obtained with solid arms; and also the end of each wrought iron tube being an extended surface of thin metal, that metal becomes very highly heated by the melted cast iron, when the same is poured into the mould, and flows round the thin

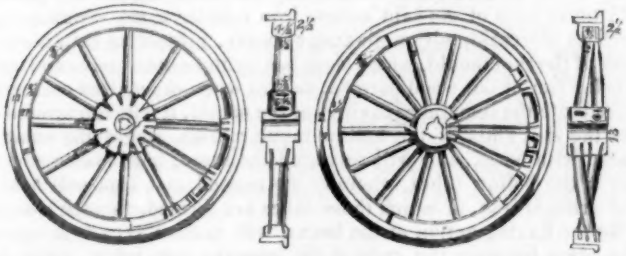
wrought iron on both sides, (namely, inside and outside of the end of the tube:) and in consequence of the previous application of borax to the said ends of the tubes, both inside and outside thereof, the borax acting as a flux to the wrought iron, the heat of the melted cast iron causes the same to unite and adhere very firmly to the wrought iron; and hence, by my improved mode, very strong wheels can be made for rail-way carriages, which strong wheels have hitherto been a desideratum for carriages, to convey passengers and goods with that great rapidity of motion which is practised in travelling on the rail-way between Liverpool and Manchester; for the violence to which the wheels of the carriages are subjected in such quick travelling, is so great that no wheels hitherto tried on that rail-way have been found sufficiently safe and durable.

Wheels of cast iron, with wrought iron tires, are found liable to crack and to fly in pieces without any warning, and hence are dangerous for passengers; and wheels made with solid arms of wrought iron, with naves and rims of cast iron, run around the ends of wrought iron arms, (without the aid of borax as a flux:) but, according to the patent granted to Mr. Losh and myself in 1816, although hooped on the outside with wrought iron tires, are found very liable to work loose at the junctions of the wrought and cast iron; and hence, wheels with cast iron naves and wooden spokes and fellies, surrounded with wrought iron tires, have been preferred for the carriages to convey passengers on the aforesaid rail-way; but such wooden wheels wear out very fast, and require continual repairs; and wheels made according to my improved mode, will be found more durable and safe.

And for the more full explanation of my said improved mode of making weeels for rail-way carriages, I have hereunto annexed a drawing, representing two wheels which are made according to that mode.

Description of the drawing.

Fig. 1. Fig. 2.



The wheels in figs. 1 and 2 have twelve hollow spokes of thin wrought iron, each one being made by turning up a piece of iron plate, of a suitable shape, size and thickness, into the form of a tapering flattened tube, with overlapping edges, which edges are welded together on a mandril, in the same manner as gun barrels are made, except that the tubes are of a flattened oval form, as well as tapering, as

is clearly shown in the drawing. The said tubes are enlarged a little at each end, in the form of a trumpet, or bell mouths, and are prepared for casting the cast iron naves and rim around the ends of them, by carefully cleaning the ends inside and outside from all dirt and loose scales, and then applying a thin glazing of borax to those ends, either by dipping the ends of each tube in water, and sprinkling the wetted parts with powder or dust of pounded borax, so as to cover the surface of the iron, inside and outside of the tubes with borax, nearly as far as the cast iron is intended to join to the wrought iron; and the said ends so covered with powdered borax, are then to be heated by holding them in the flame of an oven or hollow fire, until the borax becomes fused, and flows upon the surface of the wrought iron, so as to cover the same with a thin glazing or coat of borax; or otherwise, borax may be melted in a suitable crucible or pot: and the aforesaid ends of the tubes being heated and dipped into the melted borax, will become covered with a thin glazing or coating of borax, as aforesaid. Note.—The hollows of the said tubular spokes should be filled up with sand, except at so much of the ends thereof as are intended to have the cast iron run into the said hollows; and likewise one or two small holes should be previously drilled through the iron of each of the oval tapering tubes, in order to let out the air which might otherwise become confined within the hollows thereof, when the cast iron is run around their two ends.

The mould for casting the iron nave and rim, is formed by the aid of a wooden pattern or model, of the same size and shape as the intended wheel, with its central nave, arms and rim complete; the pattern being made in two or more thicknesses, which separate or take apart, as may be requisite: and the mould being formed of sand, rammed hard into two boxes, which separate and take apart in the usual manner practised by iron founders for casting wheels in sand, with moulding boxes and wood patterns; and when the pattern is withdrawn from the sand, leaving the cavity or mould therein, the hollow tubular arms of wrought iron, (prepared as aforesaid,) are laid into those cavities of the mould, which were left by the arms of the wood pattern, with those ends of the said hollow iron tubular arms which are prepared as aforesaid, with a glazing of borax, projecting into those cavities of the said mould, which were left by the central nave and by the circular rim of the wood pattern, so that when the melted cast iron is poured into the remaining cavities of the mould, it will run around and into the said ends of the hollow tubular arms, where the same are glazed with borax, and will surround the same, both inside and outside of the hollow tubes, whereby the melted cast iron will heat the thin wrought iron, of which those tubes are formed, to such a degree, as by the fluxing action of the borax, will cause a very firm union to take place between the ends of the wrought iron tubes, which form the arms of the wheel, and the cast iron which forms the central nave and the circular rim thereof.

Figs. 3 and 4 of the drawing represent another wheel, made according to my said improved mode.

The arms or spokes, which are fourteen in number, are cylindrical

tubes of wrought iron, instead of tapering flattened tubes; and they are not situated in a plane, but one half of the number are dished towards one side of the wheel, and the intermediate seven spokes are dished towards the other side of the wheel, to give greater lateral strength thereto. In every other respect the construction of this wheel is the same as that of figs. 1 and 2.

Note.—It will be necessary to insert three cores of dry sand across that cavity of the said mould which is left for casting the circular rim of the wheel, whereby the said rim, when cast, will be formed in three distinct segments, with small intervals between the ends of them, in order to allow for that contraction of the cast iron which must take place, in cooling, from a fluid state, till it becomes cold.

The intervals between the said three segments are afterwards filled up with iron keys, accurately fitted therein, and they may be fastened by riveting, if necessary; and thus a wheel with a firm circular rim is formed; and around that wheel, the wrought iron hoop or tire is applied when hot, that it may contract or shrink, and fasten upon the cast iron rim in cooling.

Note.—The cast iron rim of the wheel may be cast hollow, as represented in the section, by placing dry sand cores in the mould in proper positions, to occupy the middle part of the cavity left by the circular rim of the pattern, according to the mode usually practised by founders in like cases.

It is needless to enter into any farther description of the mode of moulding, or casting such wheels, because all competent iron founders are accustomed to such operations; and because my improved mode of making wheels for rail-way carriages, consists merely in the use of hollow wrought iron tubes for the spokes of such wheels, and in preparing the ends of such hollow tubes with a glazing of melted borax, applied inside and outside, at all the parts which are intended to join to the cast iron, in order that the borax may act as a flux to the wrought iron, to cause it to unite firmly to the cast iron, which is run or cast around the ends of the said hollow spokes, to form the central nave and the circular rim of the wheel. The dimensions of the wheels represented in the drawing, may be found by measuring from the scale; they are five feet diameter, and are adapted for the wheels of a locomotive steam engine, which weighs eight tons; the wheels being turned round by the power of the engine, in order to advance the engine along the rail-way. Wheels for other kinds of rail-way carriages may be made according to the same drawings, by apportioning their dimensions to the purpose for which they are intended, and with strength corresponding to the load they are required to carry.

In witness whereof, &c. [*Ib.*

Patent granted to THOMAS COLEMAN, *of St. Albans, in the county of Hertfordshire, training groom, for an improved roller for horses. Dated March* 29, 1831.

THE dangerous consequences resulting from tight lacing, so frequently insisted upon by our medical men, and so little heeded by

the fair objects of their solicitude, have, at all events, produced one benefit—that of releasing one of the most elegant, attached, and useful creatures under heaven, (woman excepted—when she has a waist of natural dimensions,) from the like pernicious treatment.

Mr. Coleman, being a rational person, and a man of observation, has discovered that the rollers in common use for horses, (for those more especially that are required to exert their speed,) being formed of a stubborn, unyielding material, have the effect of compressing the ribs, consequently of contracting the room in which the lungs perform their function, and, in the end, of rendering the animals liable to be injured in their wind.

The earlier in life these rollers are girded on—and very young colts, when they are of gentle blood, as with young ladies of the like heraldic standing, are submitted to the discipline—the more easily, of course, is the injury incurred. To obviate which, our patentee proposes providing the rollers for the horse cloths with elastic springs, flat in form, of hardened steel, upon a similar principle to elastic garters or braces. This improvement, he says, will answer all the purpose required, of confining the body cloth, at the same time that it will allow full liberty of action to the young animal's lungs.

[*Ib.*

Patent granted to THOMAS WESTRUP *and* WILLIAM GIBBINS, *both of Bromley, in the county of Middlesex, gentlemen, for improvements in converting salt or other water into pure or other water. Dated May* 24, 1831.

THE "improvement" to which these patentees lay claim, consists—first, in encircling the usual boiler appended to a ship's cooking apparatus, with another boiler destined to contain the salt or impure water which it is desirable to convert into pure liquid, fit for culinary or other domestic purposes. The steam arising from this passes through a worm pipe that is enclosed in a cylinder, situated between the decks of the ship, and *below* the water line. In the upper and lower parts of this cylinder are tubes communicating with the external water. As, therefore, it is the property of heat to ascend, the lower pipe will constantly receive a stream of cold water, while the heated water will pass out through the upper tube. The reader need not be informed that the condensed steam in the worm pipe, passes through the bottom of the cylinder into a receiver.

The patentees have added a more simple and economical mode than the above, of condensing the steam; which consists in passing the condensing pipe over the bows of the vessel by the side of the keel, (where it will be at little risk of injury from contusion,) and reintroducing it at a convenient distance below the water line.

Having thus described the principle of the patent, it is unnecessary to add, that so long as there is a fire in the kitchen range, and water in the boiler, no other labour or attention is requisite for the purpose of obtaining a constant supply of that purest of all liquids, distilled water. [*Ib.*

FRENCH PATENTS.

Patent granted to Messrs. Victor Fougere, *Bronze Manufacturer*, Herard de Villieres, *Varnish Maker, and* Emanuel Meunier, *all of Paris, for a decoration upon Brass,* Manheim, *or Gilding; imitating Mother-o'-Pearl, burnished Gold, dead or bright Silver, &c.*

The instructions for preparing the above decorations are, to take a plate of brass, copper or *manheim*, bite it with aquafortis, then burnish, and afterwards cover it with what is known in the trade under the name of common or simple varnish (*petit varnis:*) add to this liquid $\frac{1}{10}$th of copal varnish, and $\frac{1}{20}$th of essence of distilled turpentine. When the plate is thus overlaid, it is dried in the air for two or three days, and bitten until the bright metal not decorated, becomes dead. When the brass is thus prepared, it is silvered with the following preparation:—

Composition for silvering unpolished brass, and mode of using it.

Dissolve in a pound of aquafortis an ounce of virgin silver: when it is thoroughly dissolved, it is precipitated with a quarter of a pound of fine salt, dissolved in a half pint of water. The residue of this precipitation is washed in ten different waters, after which it is mixed with two lbs. of cream of tartar, and two pounds of purified salt, and made into a paste slightly liquid. With this composition the brass is silvered, observing the neatest precision, and rubbing the plate with a fine linen until it be completely covered, and present a perfect dead surface.

The plate having been thus silvered, it is cleansed in fresh water and thoroughly dried; when the size is diluted with essence of turpentine till the metal becomes brilliant, after which it is covered with the composition known by the name of *English* varnish.

For an imitation of burnished gold in a bronze ground, the same preparatory steps already described, are taken. When the size is dry, it is bitten, and afterwards bronzed in the following manner:—A copper farthing is dissolved in an ounce of aquafortis: with this is mixed a gallon of vinegar, two drachms of salt of nitre; and with a hair pencil the plate is covered till the whole be equally bronzed; after which the size is diluted, and the varnish laid on, as already described.

Decoration of a bright or dead silver on a bronze ground.

The brass or copper plate is silvered dead or burnished, and decorated as has been already described. The silvered brass, not decorated, is reduced to the state of dead, or unpolished brass, by biting. It is then bronzed, diluted, and varnished as detailed above.

Decoration of brilliant silver on a dead ground of the same.

The brass or copper plate is silvered, burnished and decorated as

before described. When the decoration is dry, the plate is slightly bitten, and the dead, or unpolished character, is given to it as in the first description.

These decorations may be interlocated by colours of every description. [*Ib.*

Patent granted to Monsieur BASTIER, *of Paris, for a process of culture, bleaching, and platting Straw, destined for the manufacture of Hats, from what is termed Italian Straw.*

Cultivation of the Plant which furnishes the Straw.

THE plant which supplies the straw calculated to make the hats from what is termed Italian straw, is a species of wheat known in Tuscany under the name *Marzajolo grano gentile rosso*, (triticum asticum, trimenon;) however, any other species of wheat will answer the purpose, since all are but modifications of the same primitive plant from the culture of different soils, in different climates: all depends then upon the mode of cultivation, the choice of soil, upon its exposure, temperature, &c.

The ruling principle in this cultivation consists in making every thing bear, upon obtaining a frail, attenuated, and hunger-starved plant—in fact, to degenerate it: thus in the management of it, the object is to produce a precisely opposite result from the one commonly sought. The end of ordinary cultivation is to produce a strong plant, vigorous, and well seeded: in the present instance, the most feeble and meagre growth is the point of perfection, the grain not being a desideratum.

The soil then should be extremely poor and sandy; upon lofty elevations, and amid flints and pebbles, this wheat is most favourably produced.

The preparing of the ground is the same as for other descriptions of corn, with the exception that no manure is laid upon it. In Tuscany they till very lightly: the grain is sown in autumn or in spring, but more commonly in autumn, because the straw is reaped more early, and the preparation for the manufacture may be entered upon more promptly; for if the straw be laid by from year to year, it will not bleach so favourably. It is requisite to sow thickly, for the grain comes up, in consequence, more slenderly, and, of course, in more considerable quantities. It is unnecessary to allude to weeding, or the other duties requisite in agriculture.

As soon as the stalk has gained sufficient strength, which may be easily proved by breaking it, it is reaped. This moment varies between the blossoming of the grain and its full maturity, according to the quality of the seasons, soil, &c. The straw of the wheat that is suffered to ripen for seed, serves for the coarser description of hats. As the plant is naturally short, it is plucked up in order that its length may not be curtailed by cutting it with a sickle or scythe.

When the plants are gathered, they are collected in small sheafs of three or four handfuls, and allowed to remain as many days upon the ground: the dew assists in the bleaching: but if the weather threaten rain, they must be quickly housed, for if they be wetted, they will be spoiled, and rendered unserviceable for the purpose intended—at least in the manufacture of white hats.

This mode of cultivation is of course susceptible of many modifications, according to the nature of the soils, their situation, the temperature, climate, &c. it would be as tedious as useless to enter into detail on this head; the main points being laid down, they will be found sufficient for every one who possesses any experience in agriculture.

Making of the Hats.

The straw being gathered, it is requisite to separate that part which is to be employed in the manufacture of the hat, that is, the upper part, from the first knot to the ear. This operation it is less difficult to perform than to describe. When separated, it is collected into small bundles, and the process of bleaching commences, which is accomplished in the following manner:

The straw is put into a large wooden chest, until it be filled, with the exception of the centre, that is reserved for a chafing-dish, lighted: the lid of the chest is closed as closely as possible, and in this state it is suffered to remain three or four days. No metal must be used in the making of this chest.

The straw being bleached, it is picked and culled, in which operation the spoiled, rank, and too large stalks are rejected; and the different qualities of straw, to the number of sixty, according to their delicacy, are separated; and of these, sixty qualities of hats are manufactured.

When picked and sorted the platting commences. This art is easily learned, and need not be described. Suffice it to say, it differs not from the ordinary mode in the common straw hats. The platting is begun with five straw threads, and gradually increased to nine, until the whole of the bottom of the hat be finished, and thus they continue the whole. The platting being completed it is sowed, after previously cutting off the projecting straws. The sowing of the plats is made upon a form, of which they take the figure. The sewing, which should be managed so as not to expose the threads, is effected by passing the needle under the straws in the platting. The rim of the hat should be from time to time withdrawn during the sewing, to prevent its becoming distorted. It is commonly by the number of rows or plats composing the rim, that the fineness of the hat is distinguished; since this rim being of a settled dimension, the finer the plat, the more material is included in the plat. The straws that exceed the level of the plats are again clipped with scissors.

The hat being completed, it is polished, calendered, and bleached: before it is calendered, and after having been fumigated with sul-

phur, the straws which have too yellow a hue, or are otherwise defective, are removed: the vacancies also in the plats are filled up. The straws are removed by needles and scissors; and the vacancies are supplied by means of a needle threaded with a straw. The hats are smoothed with polishers, passing them uniformly the same way; which instruments are commonly made of box wood, of a wedge form, with a single handle, uniting at its base.

They are calendered with a long heated iron of about fifteen pounds weight, passing it also the same way over the plat.

The fumigation by sulphur is performed before the hats are either polished or calendered, and in the same chest in which they were first bleached; being previously slightly damped; and they are allowed to remain in the vapour from twenty-four to seventy-two hours. Finally, those of an inferior quality or colour are dyed black.—*Brevets d'Inventions.*

Patent granted to Francis Doderot, *Embroiderer, Paris, for the employment, in embroidery, of transparent and opaque cuttings of Quills, of Tortoise-shell, and of Whale-bone.*

This invention consists in embroidering with spangles made of quill, tortoise-shell, and whale-bone, as they have hitherto been manufactured of steel. The above materials, varied under an infinity of different forms, and shaded in every colour, produce a more airy decoration, it is less liable to accident, and is more agreeable to the eye than any hitherto known.

Two improvements have been added to this invention; the one, that of rendering the quill of so brilliant a white as to resemble mother-o'-pearl; and the other, that of employing in the embroideries of gold and silver thread, thread of horse-hair and whale-bone.—*Ibid.*

A Dial, or Watch, for indicating the precise time of Observations. By Monsieur Jacob.

The watch of Monsieur Jacob is composed, according to custom, of five wheels and a cylindrical escapement. It performs 18,000 vibrations in an hour; that is to say, five every second. The hand then makes five little leaps in each space between the divisions of the dial. The stay of the hand can act upon one only of these leaps, which limits the inaccuracy in the movement to less than a fifth of a second, a precision amply sufficient for the required purpose. When the machinery is to be set in motion, this is effected by pressing a button similar to that used in repeaters, the action of which may be stopped at pleasure, according to the will of the person making the observation. The arrested hand is then examined, and the second, with its fraction of stoppage, is noted: this fraction is obviously the place at which the stoppage was made, in dividing the whole space between

the two divisions into five parts, noting at the same time, that this limb should be centred and divided with great care, to prevent inaccuracy.

The observation being noted, to proceed to another, the pin is pressed with the finger to set the second hand in motion, and in an instant it is observed to hasten to regain its place. The inventor, the better to show the truth of this movement, has furnished another hand, which is not stopped with the former, in order that it may be perceived that this has in fact resumed its place and overtaken the other. This part of the mechanism consists in connecting with the small middle wheel a pinion of the same number as that of the seconds wheel, and in carrying the other moving hand upon the extension of the axis of this pinion, the centre of another seconds dial.—*Bull. de la Société d'encouragement.*

Machine for Dressing Cloth. By Monsieur Beauduin Kamenne.

The object of this machine is to obtain a greater degree of celerity in the napping of cloths, added to a greater perfection in the same operation, than that accomplished by any other mechanism. Although it is constructed upon the same principle as the machines already well known, it nevertheless varies from them in an essential degree, inasmuch as the teazels with which the cylinders are supplied, seize the cloth with double effect, and, consequently, give at the same moment two strokes for one.

In another particular also, not less important, it differs from the machines already in use, and that is, that it dispenses with the necessity of the workman's removing the teazles for the purpose of cleaning them; since that operation is effected spontaneously and incessantly, as the work itself proceeds, and without loss of time, by means of a second cylinder furnished with brushes, and revolving with great rapidity.

The advantages which this machine presents over those now in use, consist, first, in the cost of labour being diminished, and the produce being double that of the common machines: whence it results that half the time requisite for completing this department in the preparation of cloth, is economised. Second, in the economy of expense and time bestowed in cleaning, which was heretofore entrusted to children; moreover, in husbanding the teazles, whereby their duration is extended. Third, finally, in the force consumed, being much less than that of two common frames; the whole, at the same time, occupying the space of one frame only.—*Descript. des Brevets.*

On the Strength and Best Forms of Cast Iron Beams.

[Continued from p. 208.]

These experiments show very clearly that as the elasticity of the material is impaired by the weights applied to it, the deflections by extension and compression become unequal. We are thus prepared

to discuss the question whether the force required to destroy the elasticity of cast iron by tension, is equal to that which is required to effect the same result by compression.

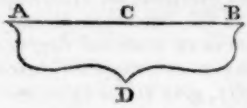
That a greater force is required to destroy the elasticity of cast iron by compression than by tension is shown by the following experiments.

"23. I took two castings, apparently precisely alike, whose dimensions in the section were the same as in the last experiment, (expt. 4,*) and placing the ends of each of them upon two props, four feet three inches asunder, broke them by weights in the middle, one with the broad part downwards thus (⊥), and the other with it upwards, (T).

The first bore $8\frac{3}{4}$ cwt. and broke with 9 cwt.

Deflection in the middle with 4 cwt. .6 inch.
" " " $8\frac{1}{4}$ " 1.8 "

"The weights were laid on very gently, and the casting showed no signs of approaching rupture, except a small increased deflection; but when it broke, a piece flew out whole from the compressed side, of the form below, where AB = 4 inches, and CD = .98 inches, the point D at the bottom being in or near to the neutral line. AB was in the direction of the length of the casting, and the weights were laid on at C. Hence since the depth of the casting was 1.35 (expt. 4,) $CD = \frac{.98}{1.35}$ depth $= \frac{5}{7}$ of it nearly.



"This experiment is interesting; it shows the situation of the neutral line, and may, from the peculiar form of the wedge, throw some additional light on the nature of the strain.

"The other casting bore $2\frac{1}{4}$ cwt. and broke with $2\frac{1}{2}$ cwt.

"The strength of the castings was, therefore, as $8\frac{3}{4}$ to $2\frac{1}{4}$, or as 4 to 1 nearly, according as they were broken, one or the other way upwards.

"Those who suppose the strength to be bounded by the elasticity, and that the same force would destroy the elastic power, whether it tended to extend or compress the body, must have conceived these castings, and indeed those of every other form, to be equally strong, which ever way upwards they were turned. A conclusion which we see would lead to very erroneous results, if applied to measure the ultimate strength of cast iron."

At this stage of Mr. Hodgkinson's progress, he was rescued from the necessity of proceeding upon a small scale in his experiments, by the liberality of Messrs. Fairbairn and Lillie, who undertook to have the experiments made at their own expense, the castings being furnished from their own foundry.

"26. I felt desirous of making, on malleable iron, experiments

* Page 207.

similar to those already given on cast iron, and for this purpose a bar about six feet long was made. It was of the same form as those used in cast iron, its section being uniform throughout, and in the shape of a T, of which the top was five inches broad, and three-eighths of an inch thick, and the vertical part, or leg, one and one-eighth inch deep, and nearly one-fourth inch thick. In the experiments, one end was fixed horizontally and firmly wedged into an immoveable object, a large stack of pig iron, and weights were hung at three feet distance, where the deflections were taken. The experiments were made nearly in the same manner as those on cast iron; only here, we did not subject the same part to both tension and compression, but contiguous parts. Thus, suppose the first experiment was to extend the vertical rib, the next experiment would be to compress it in a part very near to the former place; the piece having been taken out of its fastenings, rendered straight if necessary, and fastened again, the other side upwards, by the part which was most strained before. This mode was used, turning and shifting the piece, throughout its whole length; and toward the conclusion of the experiments, the weights were increased till the vertical rib exhibited signs of being drawn out and crushed.

"27. The results from these experiments were anomalous, partly through defective fixing;* but they left no doubt that the extensions, and compressions, were nearly equal from the same forces, and that through their whole range: and therefore that forces not very unequal would have destroyed the piece, whether the rib was drawn out or crushed; a result very different from that which was obtained in cast iron.

"The mean results from the extensions and compressions, with the three greatest weights laid on, were as below—

Weights.	Deflections from extension.	Deflections from compression.
585	1.40	1.54
697	2.00	2.56
809	4.75	4.79 "

To strengthen the inference from these results, our author quotes the experiments of M. Duleau upon the same subject. As the method pursued is ingenious, the subjoined translation of the quotation may be acceptable. (Essai Théorique et Expérimental sur la résistance du fer forgé.)

"A bar of wrought iron of square section, $\frac{4}{5}$ of an inch on a side, was bent, when cold, into the arc of a circle, two of its faces remaining plane. Upon these two faces lines had been drawn perpendicular to the axis of the bar, and one inch apart. The bar was bent in three different experiments in different degrees: in the first, for a length of arc of one foot the deflection was $\frac{7}{8}$ths of an inch, in the

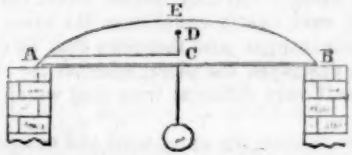
* This objection did not exist in the experiments on cast iron, for in those the castings were rendered utterly immoveable, by means of powerful screws.

second $1\frac{1}{2}$ inch, and in the third $2\frac{3}{8}$ of an inch. The lines drawn upon the plane faces remained straight, and the increase of length of the convex side was just equal to the diminution in length of the concave."

We follow the author into the second part of his inquiry; that having reference to the influence of form upon the strength of cast iron beams.

"29. The intention of the preceding experiments, on the elasticities of cast and wrought iron, being to prepare in some degree the way to an inquiry into the best form of beams of those metals, particularly of cast iron, we will now reconsider the strain which beams are subjected to, with a view to their proper formation to obtain the utmost strength. If, then, we conceive a beam, supported at its ends, and bent by a weight any where laid upon it, we have seen that all the bottom fibres, or parts, must be in a state of tension, and the top ones in a compressed state, and if C and D be the centres of tension and compression,* the forces in C will be just equal to those in D, where D may be considered as the fulcrum of the bent lever DCA.

Fig. 3.



"In order to increase the arm CD of the lever, and consequently the strength of the beam, the parts should be disposed as far asunder as possible.† This would perhaps be best effected by putting two strong ribs, one at top, the other at bottom, the intermediate part between the ribs being a thin sheet of metal to keep the ribs always at the same distance, and thereby to prevent derangement from irregular strains, as well as to serve another purpose, which will be mentioned further on.

"30. As to the comparative strength of these ribs, that appears to me to depend upon the nature of the material, and can only be derived from experiment. Thus, suppose it was found that it required the same force to destroy the elasticity of a piece of metal, whether the force acted by tension or compression. In this case, the top rib ought to be equal to the bottom one, supposing it was never intended to strain the beam so as to injure its elasticity. And if it were found that the same weight would be required to tear asunder or to crush a piece of metal, according as it acted one way or the other, the beam should have equal ribs to enable it to bear the most without breaking. Now, from the experiments given above, it appears that these qualities are in a great measure possessed by wrought iron; and therefore

* See our remarks, p. 205. † Refer again to remarks, p. 205.

whether it was intended to strain a beam of it to the extent of its elasticity, or even to the breaking point, there ought to be equal ribs at top and bottom.

"31. If, however, the metal were of such a nature that a force, F, was needed to destroy its elasticity by stretching it, and another force, G, to do the same by compressing it, it is evident that the ribs ought to be to one another as F to G, in order that the beam might bear the most without injury to its elasticity. And if it took unequal weights, F′ and G′, to break the piece by tension and compression, the beam should have ribs, as F′ to G′, to bear the most without fracture.

"Our experiments on cast iron were not well adapted to show what relative forces would be required to destroy the elasticities; but it appears, by the experiments of Mr. Rennie, that it would take many times the force which would draw it asunder, to crush it. The bottom rib must then be several times as large as the top one to resist best an ultimate strain.

"32. This last matter must be considered with some modifications; it would not perhaps be proper to make the size of the ribs just in the ratio of the disruptive to the crushing forces, as the top rib would be so slender that it would be in danger of being broken by accidents.

"33. The thickness, too, of the middle part of the beam, or that between the ribs, is not a matter of choice; independent of the difficulty of casting, it cannot be rendered thin at pleasure, but must have a certain thickness, though in long beams the breaking weight is small, and a very small strength of middle is necessary.

"The neutral line being the boundary between two opposing forces, those of tension and compression, it seems probable that bending the beam would produce a tendency to separation at that place. Moreover, the tensile and compressive forces are, strictly speaking, not parallel; they are deflected from their parallelism by the action of the weight, which not only bends the beam, but tends to cut it across in the direction of the section of fracture; and this last tendency is resisted by all the particles in the section. Thus, in the figure 1,* the force of compression is not in the direction *Io* produced, but in a direction downwards, oblique to that. It is composed of the force in *Io* produced, and that part of the weight W, whose vertical effect is sustained by the lower part of the beam. This compounded force will then tend to separate the compressed part of the beam in the form of a wedge, and this tendency must be resisted by the strength of the part between the ribs, or flanges. We have already given one instance of fracture this way, and there will occur several others in the course of our experiments.

"34. We see then that there are three probable ways in which a beam might break, 1st, by tension, or tearing asunder the extended part; 2nd, by the separation of a wedge, as above; and 3d, by compression, or the crushing of the compressed part. I have not, however, obtained a fracture by this last mode in cast iron."

* See figure p. 204.

We deem it unnecessary to give the details of an experiment made upon a beam with flanges, in which the sum of the breadths of the upper and lower ribs were constant. Such a figure would be formed by placing a board upon one of its longitudinal edges, and nailing two triangular pieces to the two edges, the base of one triangle being opposed to the vertex of the other. The quantity of matter in every cross section of this beam would be the same. The results were not generally satisfactory, but one of them is worth noticing, namely, that the beams being supported at one end, and weights applied at different distances from the opposite end, fractures very frequently took place at a distance from the supporting shoulder, at the section where the breadth of the upper and lower flanges were just equal, this being, according to Tredgold, the *strongest section* of the beam.

"36. The indecisive character of these experiments, Mr. Ewart was of opinion might arise from their having been made on too small a scale, and he suggested to me the propriety of repeating them on a larger one: which was done, and the results show a degree of uniformity, which forms a striking contrast to the others. The mode, however, of making the experiments was varied; for, as I had met with difficulty in getting sufficiently good castings from the form of model before used, and as Messrs. Fairbairn and Lillie had a very convenient apparatus, a long lever, for trying or breaking beams, I felt rather more desirous of making the future experiments on small beams, since the results would be more useful in that form.

"37. The form we first adopted was one in which the arc AEB, (figure 3,*) was a semiellipse, and the bottom rib a straight line; but the sizes of the ribs at top and bottom were in various proportions; the ribs in the model were first made equal, and when a casting had been taken from it, a small portion was taken from the top rib and attached to the edge of the bottom one, so as to make the ribs as one to two; and when another casting had been obtained, a portion more was taken from the top, and attached to the bottom as before, and a casting made from it, the ribs being then as one to four.

"In these alterations the only change was in the ratio of the ribs, the depth and every other dimension in the model remaining the same.

"38. In most of the experiments the beams were intended to be broken by a weight at their middle, and, therefore, the form of the arc AEB was of less importance; in making them elliptical they were too strong near the ends for a load uniformly laid over them; the proper form is something between the ellipse and parabola. It is shown, by most of the writers on the strength of materials, that if the beam be of equal thickness throughout its depth, the curve should be an ellipse to enable it to support, with equal strength in every part, a uniform load; and if there be nothing but the rims, or the intermediate part be taken away, it is shown by Hutton in his Treatise on Bridges, or in my Paper, Manchester Trans. 1831, page 364, that

* See figure p. 264.

the curve of equilibrium, for a weight uniformly laid over it, is a parabola: when therefore the middle part is not wholly taken away, the curve is between the ellipse and parabola, and approaches more nearly to the latter, as the middle part is thinner. Mr. Tredgold states the proper form of the curve to be an ellipse.

"39. The instrument used in the experiments was a lever, about fifteen feet long, placed horizontally, one end of which turned on a pivot in a wall, and the weights were hung near to the other; the beams being placed between them and the wall. In the first seventeen experiments, the beams were placed at three feet distance from the pivot in the wall, and in the other experiments, at two feet, except otherwise mentioned.

"All the beams in the twenty-two experiments immediately following each other, were exactly five and one-eighth inches deep in the middle, and five feet long, and were supported on props just four feet six inches asunder. The lever was placed at the middle of the beam, and rested on a saddle, which was supported equally by the top of the beam and the bottom rib, and terminated in an arris at its top, where the lever was applied. The deflections were taken in inches and decimal parts, at or near the middle of the beam, as mentioned afterwards. The weights given below are the whole pressure, both from the lever and the weights laid on, when reduced to the point of application on the beam. The dimensions of section in each experiment were obtained from a careful admeasurement of the beam itself at the place of fracture, which was always very near, (usually within half an inch of,) the middle of the beam, the depth of the section being supposed to be that of the middle of the beam, or five and one-eighth inches.

"As the experiments were made at different times, and there might be some variation in the iron, though it was intended always to be the same, a beam of the same length and depth as the others, but of the common form, always from the same model, was cast with each set of castings for the sake of comparison.

"40. The first six beams in the first series were cast *horizontal*, that is, each beam lay flat on its side in the sand; all the rest were cast *erect*, that is, each beam lay in the sand, in the same posture as when it was afterwards loaded, except that the casting was turned upside down when in the sand.

"In all the experiments, the area of the section was obtained with the greatest care; it includes, besides the parts of which the dimensions are given, the area of the small angular portions at the junction of the top and bottom ribs with the vertical part between them.

"41. The principal objects proposed in the experiments were: first to seek, directed by theory, the form of section, in which a cast iron beam would be the strongest, up to the time of fracture, its length and depth being given: next, to obtain, if possible, a general rule for the strength of such a beam then, since the rules given in the commencement of this paper, * only apply, in cast iron, so long as the elasticity is perfect."

* Those deduced by the author from theoretical considerations, sketched at the beginning of our remarks. See notes p. 205.

The nature of our work would render it inexpedient to extract the details of the thirty-six laboured experiments given by the author. We must content ourselves to give specimens of his mode of experimenting, and then present his deductions to the reader.

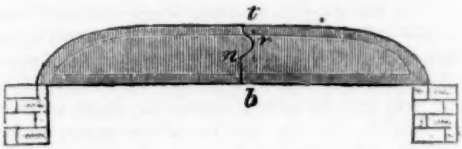
I. EXPERIMENT.

"Beam with equal rib at top and bottom.
Dist. between supports 4 feet 6 inches. Depth of beam $5\frac{1}{8}$ inches.

Dimensions of cross section, at place of fracture, in inches and parts.

Area of top rib $= 1.75 \times .42 = .735$
Area of bottom rib $= 1.77 \times .39 = .690$
Thickness of vertical part between the ribs, $= .29$

Area of above section $= 2.82$ inches.
Weight of casting $= 36\frac{1}{4}$ lbs.
Breaking weight 6678 lbs. $= 59$ cwt. 70 lbs.



"The form of fracture is represented by the line $b\ n\ r\ t$, where $t\ r = .6$, and $b\ n = 2.5$, the figure being a side view of the beam.

"To find the strength per inch of cross section, we have, dividing the breaking weight by the area, $\frac{6678}{2.82} = 2368$ lbs. per inch. This quantity in each beam may be taken as an index of its strength, and we shall use it to compare together the strengths of those beams that are of the same length and depth, which is the case in the first twenty-two experiments.

"Comparing this with the result from expt. 4, where the beam bore 2584 lbs. per inch, gives $2584 - 2386 = 216 =$ defect.

"$\therefore$ Loss in strength $= \frac{216}{2584} = .083$ or $\frac{1}{12}$ nearly, in parts of what the common beam bore.

"The form of section above is essentially what Mr. Tredgold has represented to be, that of the strongest beam, while the elasticity is perfect—our future experiments will render it probable that it is in this respect nearly as defective as it is in its ultimate strength."

The second experiment was with a beam in which the areas of the section of the top and bottom rib were as one to two. Strength per

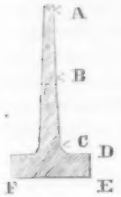
square inch of section 2567 lbs. In the third the areas of the top and bottom rib were as one to four. The strength 2737 lbs. per square inch.

We subjoin the details of the fourth, fifth, and sixth experiments.

IV. EXPERIMENT.

"Beam cast in common form from Messrs. Fairbairn and Lillie's model.

Distance between supports and depth of beam as before.



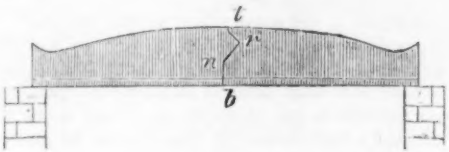
Dimensions of section in inches.

Thickness at A = .32
" " B = .44
" " C = .47
FE = 2.27
DE = .52

Area of section = 3.2 inches.
Weight of casting = 40¼ lbs.
Deflection with 5758 lbs. .25 inches.
" " 7138 " .37 "
Breaking weight = 8270 lbs.

"The beam twisted a little before breaking: this, however, was not usually the case in the other beams from the same model.

"Form of fracture as in figure, $tr = .75$.



"Hence strength per inch of section $= \frac{8270}{3.2} = 2584$ lbs.

V. EXPERIMENT.

"This casting had its top rib a parabolic arch, and the top and bottom ribs nearly equal in section, with equidistant ordinates only between them.

Distance between supports and depth of beam as before.

Dimensions of ribs in inches.

Area of top rib $= 2.2 \times .56 = 1.23$
Area of bottom rib $= 2.2 \times .53 = 1.17$
Weight of casting = 41½ lbs.
Breaking weight = 5528 lbs. or less: see next exp't.

"This weight, however, is but two-thirds of what was borne by the common beam in the last experiment.

"It broke by separating near the first ordinate, as in the figure, the top part remaining whole; the weight having been removed as soon as the fracture commenced.

"This is represented by Mr. Tredgold, 'Essay on Strength of Cast Iron,' to be a very economical form of beam. It would, there is little doubt, have resisted much more tenaciously if the weights had been laid uniformly over it; but this experiment shows the great weakness of the beam when the weight is applied at a single point, and therefore the danger of using it in practice.

VI. EXPERIMENT.

"A parabolic arch, differing from the last only in its having a portion taken from the top rib and added to the bottom, leaving the height as before, and the ratio of the ribs one to two nearly.

Distance between supports and depth as before.

Dimensions in section of the ribs.

Area of top rib $= 2.2 \times .36 = 0.79$ inches.
Area of bottom rib $= 2.2 \times .75 = 1.65$ "
Weight of casting $= 43$ lbs.
Breaking weight $= 5528$ lbs.

"It broke quite off in the same place as the last did.

"Both this casting and the preceding one broke with the first weight laid on them, 5528 lbs., and probably would have done so, particularly the former, with several hundred weight less. The latter casting was doubtless the stronger, as it had more matter in the bottom rib, and they both broke by tension, or by drawing asunder the bottom part: which had indeed been the case with every beam we had tried.

"All the preceding experiments were made on beams cast on their side, from iron, of which the following is a description.

Mixture.

$\frac{1}{3}$ of Blaina, No. 2, } Welsh.
$\frac{1}{3}$ of Blaina, No. 3, }
$\frac{1}{3}$ of W S S, No. 3, Shropshire.

"This mixture is a strong iron, and therefore well suited for beams."

In the seventh experiment a beam cast *erect*, but upside down from the same model as in the fourth experiment, and under a superior head of metal, bore 3188 lbs. per square inch.

Experiment 8th was with a beam modelled as in experiment 3d, but the area of section of the top rib to that of the bottom as 1 to $3\frac{1}{2}$;

strength 2683 lbs. This beam was cast, by mistake, with the broad rib lowest.

Experiment 9th. In this was used the model of the last experiment with one inch in breadth added to the bottom rib. Ratio of the areas of top and bottom rib as 1 to 4¼ nearly. Strength 3183 lbs. Gain in strength over beam of experiment 10, nearly one-seventh.

"*Remark.*—Though this beam had a larger bottom rib, it still broke by tension, or by tearing asunder the bottom part first, as was evident since it had neither been crushed nor broke by a wedge, (Art. 34;) this I had noticed to be the case in every experiment, (see expt. 6.) There had been one-seventh gained in strength, above that of the common beam,* by the addition already made, and it was probable, we might add still more to the lower rib without danger of fracture by compression; for in no case, except of the common beam, which sometimes twisted a little before it broke, had there been the slightest appearance of over compression. This idea will be pursued in our future experiments."

"Experiment 10. Common beam cast upside down, in the usual manner. This, like the rest, was from the same model as that in experiment 4." Strength 2792 lbs.

"In the following experiments, the bottom rib is considerably increased, agreeably to the remarks made on experiment 9, but for fear lest the top rib should be overpowered, and by its compression the point of support thrown lower down the beam, and consequently the beam weakened, the top rib was a little strengthened likewise.

"The bottom rib will continue to be increased by small degrees, till such time as the beam breaks by compression, or by the separation of a wedge; at which point perhaps, we shall have arrived at nearly the strongest form of section, for the same depth of beam and quantity of section."

[TO BE CONTINUED.]

On the Friction and Resistance of Fluids. By GEORGE RENNIE, *Esq. V. P. R. S.*

Read before the Royal Society, June, 1831.

WHEN on a former occasion I communicated the results of a series of experiments on the friction and resistance of the surfaces of solids, (Philosophical Transactions for 1828,) I stated that they formed part only of a series of experiments on the nature of friction generally. My object at first was to trace the relation subsisting between the retardation produced by the surfaces of solids in motion when in contact with each other and with fluids; but finding that the subject connected with either of these branches was sufficiently extensive, I

* See experiment 10 which follows.

deemed it necessary to postpone the second part of the inquiry to a future occasion. Those experiments, however, established some important facts. They showed that (within the limits of abrasion,) friction was the same for all solids, and that it was neither affected by surface nor velocity. Subsequent experiments upon rolling bodies of great weight and magnitude, when the resistance was reduced one-thousandth part of the mass, and the surfaces in the ratio of thirteen to one, have corroborated the affinity of resistance between rolling and sliding bodies. Thus in connecting and continuing the isolated experiments of Coulomb and Vince, and assigning values to the abrasive resistances of most of the most useful solids, a considerable advance has been made in the science.

The subject of the present paper, however, involves difficulties of a more complicated kind. The theory of solids as deduced from the laws of mechanics, and independent of experiment, may be applied to any system of bodies; but the theory of fluids, in which the form and the disposition of the particles, or the laws of their action, are unknown, must necessarily be founded on experiment; and even with this aid, which can only be obtained through the intervention of a solid, our knowledge of the true properties of fluids must be vague and uncertain. Accordingly we find that the subject of fluids attracted the attention of some of the most distinguished mathematicians and philosophers of Europe for the last two centuries; that is, from the year 1628, when Castelli first published his treatise on the measure of running water, down to the hydraulic investigations of Eytelwein and Young. Between these periods, Italy, France, Germany and England, added their contributions to the science. But it is to the Italians principally that we owe the foundation of it, in their numerous investigations and controversies on the rivers of Italy; hence the writings of Castelli, Viviani, Zendrini, Manfredi, Polini, Frisi, Gulielmini, Lechi, Michellotti, and of many others.

Each of them has endeavoured to establish a theory applicable to rivers and torrents, but in general with indifferent success. The science again received fresh accessions from the more valuable investigations of Bossut, Dubuat, Venturi, Funck, Brunning, Bidone, Coulomb, Prony, Eytelwein and Girard; and among our own countrymen, of M'Claurin, Vince, Matthew Young, Dr. Jurin, Professor Robinson, and the late Dr. Thomas Young. Sir Isaac Newton had already demonstrated, in his celebrated propositions, 51, 52, and 53, of the Principia, (in the case of a cylinder in motion immersed in a fluid,) that the resistance arising from the want of a perfect lubricity in fluids is (cæteris paribus,) proportional to the velocity with which the parts of a fluid separated from each other; and that, if a solid cylinder of infinite length revolves with a uniform motion round a fixed axis, in a uniform and infinite fluid, the periodical times of the parts of the fluid thus put in motion will be proportional to their distances from the axis. This theory (although conformable to experiment,) was objected to by Bernoulli and D'Alembert, on the ground that Sir Isaac Newton had not taken into consideration the centrifugal force or friction arising from the pressure of the concentric rings

or filaments round the cylinder, the fluid being supposed in a state of permanence, and the friction of the rings equal throughout.

Pitot (1728,) in his experiments on the water works at Marly and Versailles, was the first to demonstrate with equal velocities, and in the ratio of the volume of water, the friction of water in pipes was in the inverse ratio of their diameters; and Couplet, (1733,) Mariotte, and Deparcieux, estimated the difference between the real and calculated expenditures of glass tubes and pipes.

Chezy (in 1771 and 1786,) was the first engineer who endeavoured to establish the relation subsisting between the inclination of an aqueduct and the transverse section of the volume of water it ought to carry—on the supposition that the accelerating force, due to the inclination of the bed of the conduit, is counterbalanced by the resistances of the channel in the ratio of the surface, and increasing in proportion to the square of the velocity. What Chezy had remarked was concluded by Bossut, who cleared the investigation of most of its difficulties, and demonstrated it to be in accordance with theory. He found that small orifices discharged less water in proportion than great ones on account of friction; that the vena contracta, and consequent expenditure, diminished with the height of the reservoir; he pointed out the law by which the discharge diminishes according to the inclination and number of bends in a pipe, and the influence of friction in retarding the velocity of waters moving in canals and pipes, in which he made the square of the velocity to be in the inverse ratio of the length of the pipe; he determined the co-efficients by experiment, and thus obtained a formula expressive of the conditions of the uniform motion of water in open canals. The greater part of these hypotheses may be said to have been removed by the more extensive researches of Dubuat. His great hydraulic work, published in 1779 and 1786, contains a series of the most valuable observations, whose results accord very nearly with the new formula of the motion of water in pipes and open conduits; and his experiments, with pipes inclined in various angles from the 40,000th part of a right angle to 90 degrees, and in channels which varied from a line and a half in diameter to areas of seven or eight square toises, seem to comprehend every case of inclination; so that by collecting a prodigious number of facts, both with compressible and incompressible fluids, he obtained a general expression for all cases relative to the friction and cohesion of fluids: but a logarithmic function which he introduces in it, by a sort of approximation, gives it a character of uncertainty, which restrains its use, and shows the necessity of fresh researches. Ventruri, in 1798, "Sur la Communication latérale du Mouvemens dans les Fluides," repeated and added many new facts to the experiments of Bossut, on the expenditure of differently shaped orifices and tubes, but particularly on the lateral communication of motion by the cohesion of fluids. Coulomb first approximated to the solution of the question, by a very ingenious apparatus, consisting of discs of different sizes, fixed by their centres to the lower extremity of a brass wire, and made to oscillate in fluids by the force of torsion only: he concluded that the resistance was a function, composed of

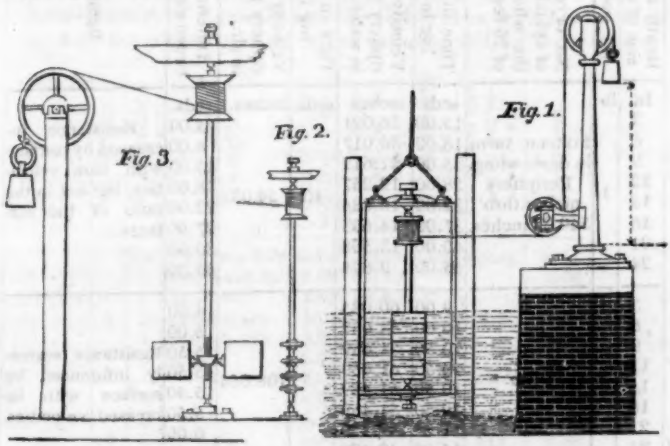
two terms, one proportional to the first, the other to the second powers of the resistance: again, that it was not sensibly increased by increasing the height of the fluid, but simply by the cohesion of the particles of the fluid which presented greater or less resistance, in proportion to the viscidity of the fluid, oil being to water in the ratio of 17.5 to 1. But whatever might be the conclusions of Coulomb, it is obvious that both the size and construction of his apparatus were ill calculated to produce results whereon to found a satisfactory theory; and accordingly both Messrs. Prony and Girard, in expressing their formulæ of resistance, have not admitted that of Coulomb, but have adopted the mean of the best of experiments made by other authors: but as these formulæ give only the mean velocity, which is much greater than the velocity (of the fluid contiguous to the pipe,) which ought alone to enter into the expression of the retarding force, it follows that the co-efficients deduced from the mean of all the experiments adopted by these gentlemen, have a value greatly inferior to the motion of the fluid contiguous to the side of the pipe or conduit. To ascertain correctly the value of this kind of resistance, M. Girard, (vide les Mémoires des Scavans etrangers for 1815,) undertook a prodigious number of experiments on tubes of different diameters and length, from which he deduced that the retardation is as the velocity simply. The effects of temperature are very remarkable: if the velocity be expressed by 10, when the temperature is 0° centrigrade thermometer, the velocity will be 42°, or increased four times when the temperature is 85°: these values must be deemed approximations only.

The contributions of British philosophers towards the improvement of this science have been, unfortunately, scanty; for, with the exception of Sir Isaac Newton, (who led the way,) Dr. Jurin, Dr. Matthew Young, Dr. Desaguliers, Dr. Vince, Mr. Smeaton, Mr. Banks, and the late Dr. Thomas Young, (see the paper of the latter gentleman in the Philosophical Transactions, and his commentaries on Eytelwein's experiments,) we can scarcely find any experiments on the subject; whatever has been effected by our engineers or scientific men, has either been withheld from the public, or consigned to obscurity; and though we have tracts of marshes and fen land, consisting of many thousand acres, the dissertations on the mode of draining and carrying off their superfluous waters are confined to local pamphlets and reports, of comparatively minor interest to the science of hydraulics.

From the foregoing short but imperfect history, it is obvious that much has been done towards perfecting this science. It is however certain, that much yet remains to be accomplished; and although we are deeply indebted to both the French and English philosophers for their extensive investigations on the laws of capillary attraction, the descents of globes in fluids, and the adhesion of fluids to metal discs, the phenomena of fluidity, and the laws which govern the motion and equilibrium of their particles, must yet remain a problem purely geometrical; and as we possess no tangible means of approximating to the solution of the problem, but through the intervention of a solid,

we must content ourselves, in like manner, with the imperfect formulæ deduced from experiments made on a small scale on the friction and adhesion of water in pipes and conduits, until we can ascertain more correctly the causes of the retardations of rivers as they occur in nature.

In the consideration of this question, I propose to examine, first, the retardations of the surfaces of solids moving in fluids at rest; secondly, the retardations of fluids over solids; and, thirdly, the direct resistance of solids revolving in fluids at rest.



To illustrate the first case, I caused an apparatus to be constructed, of which Fig. 1 in the annexed drawing is a representation; it consists of a cylinder of wood ten inches and three-quarters in diameter, and twenty-four inches long, and divided into eight sections of three inches in each, and fixed upon a spindle of iron about four feet in length, and one inch and a quarter thick. The apparatus was accurately turned and polished. Upon the upper part of the spindle, a small cylinder, or pulley, six inches in diameter was fixed, and a fine flexible silken cord, communicating with the weight, was wound; the apparatus was then fixed in an iron frame, and the frame let into a groove in two upright posts, driven into the bed of the river Thames.

The object of the frame was to allow the cylinder to slide up and down with the level of the tide, and immerse it more or less according to the experiment required to be tried. The friction of the apparatus, or the time that the weight took to descend in the atmosphere was first noticed; after which it was successively immersed in the water three, six, nine, twelve, fifteen, eighteen, twenty-one, and twenty-four inches, the difference of time showing the retardation according to the annexed table.

Experiments on the friction of the surface of a cylinder, twenty-four inches long and ten inches three-quarters diameter, moving in air and in water.

Table I.

On Surfaces in Water.

Depth of immersion of cylinder.	Wt. suspended.	No. of revolutions of cylinder falling the whole height of 26 feet.	Time in descending in water.	Velocity of periphery per secd. in water.	Time in descending in air.	Velocity of periphery per secd. in air.	Difference between air & water.	Remarks.
In.	lb		scds.	inches.	scds.	inches.	scds.	
3			15.00	36.021			5.00	
6		Sixteen turns	18.00	30.017			8.00	Resistance increased by surface
9		in descending.	25.00	21.612			15.00	with slow velocities, but not in the ratio of the surfaces.
12		Periphery	28.00	19.267			18.00	
15	1	moves thro'	32.00	16.885	10	54.032	22.00	
18		540.32 inches.	37.00	14.603			27.00	
21			40.00	13.508			30.00	
24			55.00	9.824			45.00	
3			9.00	60.035			4.00	
6			10.00	54.032			5.00	
9			10.50	51.459			5.50	Resistance scarcely influenced by surface with increased velocities.
12			10.50	51.459			5.50	
15	2	Ditto.	10.50	51.459	5	108.064	5.50	
18			10.50	51.459			5.50	
21			11.00	49.120			6.00	
24			11.00	49.120			6.00	
On Velocities in water.								
in.	lb.		scds.	inches.	scds.	inches.	scds.	
24	4		8.0	67.54	2.45	196.48	5.15	
24	8	Ditto.	6.0	90.053	2.00	270.16	4.00	Could not be tried.
24	16		4.0	135.08	1.50	360.21	2.50	
24	32		2.5	216.128				

Conclusions.

1. That the friction or adhesion of water against the surfaces of solids in motion, approximates the ratio of the surfaces with slow velocities; but that an increase of surface does not materially affect it with increased velocities.

2. That with equal surfaces the velocities do not seem to observe any fixed ratio, but approximate to the squares of the resistance.

With increased velocities the index of the power was found to be less than the duplicate ratio.

To exemplify the result of the foregoing conclusions in a different way,—the cylinder was removed, and circular discs of iron, ten inches and three-quarters diameter, and one-eighth of an inch thick, accurately adjusted to the spindle, and polished, were substituted, as Fig. 2. The friction of the apparatus was again tried, and immersed in the river Thames as before.

Table II.

Experiments on the friction in water of circular discs ten inches and three-quarters in diameter and one-eighth of an inch thick, revolving with the planes parallel to the horizon, and six inches apart.

No. of discs.	Wt. suspended.	Height fallen of weight.	Time of wt. descending in water.	Velocity of periphery per second.	Time descending in air.	Velocity of periphery per second in air.	Difference.
	lbs.	Twenty-five	scds.	inches.	scds.	inches.	scds.
	1	feet, mean cir-	10.00	42.200			8.00
	2	cle 16.88	5.00	84.400			3.00
1	3	would move	3.00	140.660	2	211	1.00
	4	through 422	3.00	140.660			1.00
	6	inches.	3.00	140.660			1.00
	1		15.00	28.133			13.00
	2		6.50	64.923			4.50
2	3	Ditto.	4.50	93.770	2	211	2.50
	4		4.00	105.500			2.00
	6		4.00	105.500			200
	1		17.00	24.823			15.00
	2		7.00	60.285			5.00
3	3	Ditto.	5.50	76.727	2	211	3.50
	4		4.00	105.500			2.00
	6		3.00	140.660			1.0 0
	1		33.00	12.787			31.00
	2		17.00	24.823			15.00
4	3	Ditto.	8.00	52.750	2	211	6.00
	4		6.00	64.923			4.00
	6		4.00	105.500			2.00

Conclusions.

That the friction or adhesion of water is not quite as the surfaces with slow velocities, being in the ratio of one to three instead of one to four, but diminishes rapidly; without observing any ratio in increased velocities.* Hence, the resistance of a ship or vessel moving

* The experiments of the Society for the improvement of Naval Architecture show a decreased resistance with increased velocities.

through the water, with an average or higher rate of velocity, forms an inconsiderable portion of the resistance resulting from the displacement of the fluid, and that the brightness observed on the copper of ships after a voyage, may be owing to other causes than the friction of the water simply.

An experiment was made to ascertain the comparative resistance of a pipe revolving in water, and with water running through a pipe; when the resistance was found to be as the surfaces in slow velocities, but to diminish greatly, as before in high velocities, without observing any fixed ratio.

The above conclusions are in contradiction of those of Coulomb, who did not find that pressure augmented the resistance, but states that the resistance is greater when the immersion is partial.

This apparatus being applicable to fluids generally, advantage was taken of it to ascertain the direct resistance of solids to fluids,* by causing plates and globes to revolve in them, with their planes perpendicular to the plane of the horizon, (see Fig. 3.)

As the resistance of solids in fluids does not form the object of this paper, it will be necessary to introduce many detailed observations on the subject of these experiments at present, connected as they are with another branch of hydrodynamics. But as it is important to show the relation subsisting between the resistances of cohesion and impulse, I have ventured to detail the following experiments.

Table III.

Experiments on the rotations of iron discs and wooden balls moving in air, with their planes perpendicular to the plane of the horizon.

Wt. suspended.	Height fallen.	Time in descending.					
		Two circular discs 10¾ inches diameter. Area 81 in.	Velocity per second.	Two square fans. Area 81 inches.	Velocity per second.	Two wooden balls 10¾ in. diameter.	Velocity per second.
lbs.	The spindle made	scds.	feet.	scds.	feet.	scds.	feet.
2	15.9 turns in falling	10.00	6.867	10.00	6.867	23	2.984
4	25 feet. Mean circle	6.00	11.445	7.00	9.810	13	5.282
9	51.83 would move	4.50	15.261	4.50	15.261	8	8.584
16	through 6 8.67 feet.	3.00	22.891	3.25	21.130	7	9.810
20		2.50	27.469	3.00	22.891	6	11.445

* In this case, the number of particles struck will be diminished in the ratio of the radius to the sine of inclination; wherefore the resistance will be diminished in a duplicate ratio of the radius to the sine of inclination. But as the sines of inclination of the two plates are equal, the resistances will be equivalent to the area of one plate (moving perpendicularly to its plane) into the duplicate ratio of the velocity of its motion, and the density of the fluid.

Conclusions.

1. That the resistances are as the squares of the velocity.
2. That the comparative resistances between discs and globes are as two to one nearly.

TABLE IV.

Experiments on the resistance of iron discs and wooden globes revolving in water.

Weight.	Height fallen.	Time in descending.					
		Two circular discs 81 inches area.	Velocity per second.	Two square fans, 9 in. square, 81 in. area each.	Velocity per second.	Two wooden balls. Area 81 inches.	Velocity per second.
lbs.	The spindle made	scds.	feet.	scds.	feet.	scds.	feet.
16	15.9 turns in falling	63	1.09	53	1.29	15.00	4.57
20	25 feet. Mean circle	54	1.27	48	1.43	14.00	4.90
32	51.83 would move	43	1.59	40	1.71	10.50	6.59
40	through 824.19 inch-	40	1.71	35	1.96	9.50	7.22
64	es, or 68.67 feet.	30	2.28	28	2.45	8.00	8.58
256		14	4.90	15	4.57	5.00	13.73

Conclusions.

1. That the resistances are the square of the velocity.
2. That the mean resistances of circular discs, square plates, and globes in air, are as the numbers 25.180, 22.010, 10.627; and in water, 1.18, 1.36, 0.755; consequently the proportional resistances of air to water, with

Circular discs, is as 1 to 21.3
Plates and fans, 1 to 16.2
Wooden balls, 1 to 2.2

Note.—A portion of the square fans, represented in Fig. 3, and equal to one-fourth of the area of each fan, was cut off, when the resistance was found to be the same as with the square fans.

Experiments on the quantities of water discharged by orifices and tubes of different diameters and lengths, and at different altitudes.

The phenomena incident to spouting fluids are,

First, The inequality observed in the velocity of the particles comprised in every horizontal section parallel to the orifice.

Secondly, The contraction of the fluid vein beyond the orifice, and consequent diminution of discharge as compared with theory.

Thirdly, The inversion and changes in the sections of the fluid vein at different distances from the orifices.

All these phenomena have been noticed and recorded by various writers, and formulæ adapted to the different circumstances of the

expenditure have been given. But neither Bossut or Du Buat, (the most accurate of writers,) have recorded a continuous and systematic series of experiments upon the comparative expenditure of orifices and tubes under the circumstances of area, altitude, and length.

The apparatus with which these experiments were performed, consisted of a wooden cistern very accurately made, two feet square inside, and four feet four inches in height. The water was kept at a constant altitude by a regulating cock; and a float, having an index attached to it, enabled the observer to ascertain the exact height at which the water stood in the cistern above the centre of the orifice.

The orifices were accurately made by Dollond in brass plates one-sixtieth of an inch in thickness. The plates were accurately adjusted to a hole in the side of the cistern, and closed by a valve of brass ground to each of the plates. The valve was opened by a lever, and the time noted by chronometers.

The diameters of the tubes, from having been drawn on mandrils, were as accurate as possible; their diameters at the extremities were carefully enlarged, to prevent any wire edges from diminishing their sections; and one extremity of the tube being inserted into a block of hard wood fastened to the cistern, and the other stopped by a valve, the experiments were recorded as before.

Constant height of the surface of the water above the centre of orifice.	Real time in discharging one cubic foot.	Theoretical time in discharging one cubic foot. $t = \frac{Q}{2A\sqrt{gH}}$.	Ratio of the theoretical to the real discharges.	Vena contracta.
Circular orifice made in a brass plate 1 in. diameter, $\frac{1}{60}$ in. thick.				
feet.	seds.	seconds.		
4	19.50	11.4	1 ; .584	
3	21	13.2	1 ; .628	Not accurately measured.
2	26	16.1	1 ; .619	
1	36	22.8	1 ; .633	
Circular orifice in a brass plate $\frac{3}{4}$ in. diameter, $\frac{1}{60}$ in. thick.				
4	33	20.3	1 ; .614	At six-tenths of an inch
3	37	23.4	1 ; .632	from the orifice, the di-
2	44	28.7	1 ; .652	ameter had contracted to
1	63	40.6	1 ; .644	0.685 of an inch.
Circular orifice in a brass plate $\frac{1}{2}$ in. diameter, $\frac{1}{60}$ in. thick.				
4	73	45.7	1 ; .626	At half an inch beyond the
3	83	52.8	1 ; .633	orifice, the diameter con-
2	104	64.6	1 ; .621	tracted to 0.37 of an inch.
1	144	91.4	1 ; .631	
Circular orifice in a brass plate $\frac{1}{4}$ in. diameter, $\frac{1}{60}$ in thick.				
4	276	182.9	1 ; .662	At $\frac{1}{4}$ in. beyond the orifice,
3	320	211.3	1 ; .660	the diameter contracted
2	396	258.6	1 ; .653	to one-twentieth inch less
1	545	365.7	1 ; .671	than the orifice.

N. B. Each result shows the mean of four experiments.

Remarks.

The phenomena relative to the form and direction of veins of spouting fluids, and the remarkable inversion of the fluid veins at certain distances from their orifices, have been so fully noticed in "Experiences sur la Forme et sur la Direction des Veins et des Courans d'Eau; par George Bidone; Turin, 1829," that it is unnecessary to state further, than that they have been completely corroborated in the foregoing experiments.

[TO BE CONTINUED.]

On the determination of the thickness of solid Substances, not otherwise measurable, by Magnetic Deviations. By the Rev. WILLIAM SCORESBY, F. R. S.

In the first part of this paper, the author states the results of a series of experiments undertaken by him with the view of ascertaining whether all bodies are equally and uniformly permeable to the magnetic influence. Out of a great number of substances not ferruginous, but of various qualities, thickness, and solidity, which were subjected to trial, no instance occurred of their offering any perceptible obstruction to the action of a magnet on a compass, when interposed between them. No interruption to this action occurred, even when the intervening bodies were iron ores, of which several were tried, excepting in one or two cases in which the ore was found to be itself magnetic. Hence, the author was led to conceive, that an accurate estimation of the magnetic influence transmitted through solid substances, might afford an excellent mode of ascertaining the thickness of such substances which might not be otherwise determinable.

In order to judge of the degree of accuracy with which this might be accomplished, he instituted various sets of experiments; first, placing the magnet in a line pointing to the centre of the compass, and on a level with it, in the east and west magnetic direction; and secondly, in positions more or less oblique to this direction. He found reason to conclude from these trials, that the degree of accuracy attainable by this method was such as to render it highly advantageous in mining operations. Thus the thickness of a mass of freestone rock on the Liverpool and Manchester rail-way, three feet two inches in thickness, was determined by this method to within the eighth of an inch of its actual measurement, exhibiting an error of only one 334th part of the whole.

Many experiments were made to determine the effect which the form, dimensions, quality, and number of magnets have on the extent of their directive influence on the compass. It was found that little, if any augmentation of power results from increasing the thickness of the magnet; but that, with magnets of similar form, the directive forces are nearly in the direct ratio of their lengths. The author gives the results of an extensive series of experiments on the combined influence of several magnets, arranged, either in contact or in juxtaposition, in a great variety of ways. The contact of dissimilar poles

was in all cases productive of an increase, and that of similar poles of a diminution of efficiency.

In the second part of this paper the author enters into an investigation of the law of the magnetic directive power, with reference to distance; in which he finds it convenient to estimate all distances in multiples of the length of the magnet employed, or, more correctly, of the interval between its two poles. From the established law of magnetic force, namely, that it is in the inverse duplicate ratio of the distance, the author deduces formula for estimating the directive power of a magnet on a compass at different distances. The combined action of four magnets, on a compass of Captain Kater's construction, which was five inches in diameter, will afford a tolerably accurate measurement of the thickness of any solid intervening substance, when about forty feet thick; but even at the distance of eighty-two feet the deviation produced by the magnet will be two minutes of a degree, and therefore still very appreciable. But the sensibility of the compass to the magnetic influence might be much further increased, by the application of a small directing magnet, placed in such a situation as to neutralize the greater part of the directive influence of the earth. By this means the author obtained a deviation in the compass of about 5′, at a distance of 61 feet, which extended through a variety of solid materials, including soil, stones, and brickwork.

In the third part of this paper the author treats of the practical application of the magnetical influence in engineering, in tunneling, and in mining, for determining the thickness of solid masses in different situations where circumstances preclude the possibility of direct measurement. He adduces a variety of instances in which the information thus obtained would prove of the greatest value, in directing the operations in progress, or determining those to be undertaken, and frequently in preventing the occurrence of accidents which the want of such knowledge may occasion. He concludes with a statement and explanation of various practical directions for the employment of the method recommended.

[*Trans. Royal Society. Phil. Mag.*

Manufacture of Vinegar from Grain. By Monsieur Dubrunfaut.

The grain employed in this manufacture is a mixture of one part malt with four parts rye; ground in the same manner as for brewing or distillation. Rye is preferred to malt, because it more easily turns acid.

In this state the corn is macerated in about six or eight times its weight of water, as in a distilling process. The soaking, fermentation, &c. is all conducted as in the making of alcohol. In fact, the result of this first stage of the operation is to make a wine.

When the fermentation has subsided, which takes place in the course of a few days, the alcoholized mass is divided into two portions, the liquid from the compact residuum; which latter is placed in a vessel to undergo distillation, the draining of this distillation is added

to the clear liquid, and passes into a heated chamber to undergo the acetous fermentation.

The heated chamber contains barrels placed upon their sides and on tressels. These barrels are half, or three-fourths, filled with liquid. To set the whole in action one-fourth or one-fifth of their capacity is supplied by vinegar prepared in the ordinary manner, together with the membraneous substance which is formed in the barrels where the vinegar is preserved. This being done, the barrels are filled to the half, or two-thirds, with the above mentioned clear decoction.

The room in which the vessels are placed should be kept at a constant temperature of from 30° to 35° of Réaumur. Every day the liquid is drawn off from each vessel, and poured upon the others. To accomplish this an empty cask is used to receive the contents of the first barrel; this receives the contents of the second, and so on in succession. This operation, by agitating and airing the liquid, favours the production of the vinegar, and it should be repeated many times a day.

By the above process the vinegar is fully developed at the end of a month or six weeks. If the whole operation have been well conducted, the half of the vinegar contained in each vessel is drawn off into small casks, placed in a cool chamber, where the clarifying is performed.

The space produced in each cask by this reduction, is filled by the alcoholized liquid, equal to the volume of vinegar that has been drawn off.

The clarification is effected with beech shavings, which possess an astringent quality. [*Agricult. Manufacturier.*

On the Thermostat or Heat Governor, a self-acting physical apparatus for regulating Temperature. Constructed by Andew Ure, M. D. F. R. S.

The principle of the instrument here described is the unequal expansion of different metals by heat. A bar of zinc, alloyed with four or five per cent. of copper, and one of tin, about an inch in breadth, one quarter of an inch thick, and two feet long, is firmly and closely riveted along its face to the face of a similar bar of steel about one-third in thickness. The product of the rigidity and strength should be nearly the same, so that the texture of each may pretty equally resist the strains of flexure. Twelve such compound bars are united in pairs by a hinge joint at each of their ends; having the zinc or alloy bars fronting one another. At ordinary temperatures these bars will be parallel, and nearly in contact; but when heated, they bend outwards, receding from each other at their middle parts, like two bows tied together at their ends. When a more considerable expansion is wanted, a series of such bars is laid one over the other. The movement thus resulting is applied by the author in various ways to regulate the opening of dampers, letting in either cold air or cold water,

or closing the draught of a fire-place, as the case may be. He proposes its employment to regulate the safety valves of steam boilers, as working with more certainty than the common expedients.

[*Trans. Royal Society. Phil. Mag.*

Note by the Editor.—The foregoing appears to be identical with the method of regulating heat for which L. W. Wright obtained a patent in August last. This similarity was referred to in noticing that patent. See pages 130, 131.

Poisoning by the (Sebacic) Acid of Goose Grease.

On the 2nd of April, 1829, Dr. Seidler was called to attend MM. H——, and their children. On his arrival he found the two brothers H——, one aged thirty-one, the second twenty-eight years, and the two children of the first, one a girl æt. four, the other a boy æt. two and a half, all presenting the following symptoms,—cold sweat, anxiety, vertigo, general paleness, and prostration of strength, eyes sunken and pupils dilated; burning pain was felt in the lower part of the belly, increased by pressure; violent vomiting, succeeded by ardent thirst, for which the patients had drunk large quantities of milk, which was thrown up without producing any effect; tongue dry; involuntary discharge of urine and fæces.

The eldest brother was insensible for six minutes; his respiration was scarcely visible, his pulse imperceptible, and the heart's action exceedingly weak. The second brother had vomited blood several times, but he experienced less abdominal pain than the other. In the little boy the globes of the eyes were turned upwards, the lips livid, and the pulse scarcely sensible. Lastly, the symptoms in the little girl were the mildest of all. M. Seidler suspected at once that these accidents were occasioned by the use of a certain quantity of goose grease, which had been employed in the preparation of some meat, of which the four patients had eaten shortly before the symptoms began. An emulsion, containing hyoscyamus, was prescribed, and on the 9th of April all had recovered.

The vomited matters were subjected to chemical analysis: they were strongly acid, but contained no metallic poison: but the following facts induced Dr. Seidler to attribute the illness to the effect of sebacic acid. The lady of the house had made use of goose grease to dress some veal, and all the persons who partook of the dish fell quickly sick. The lady herself, who had barely tasted it, felt it so disagreeable that she took no more. None of the grease which was suspected to have caused the accident, remained for examination, the pot which contained it having been entirely emptied and cleaned out; but on examining the same kind of grease contained in three other pots, it was found to exhale a strong repulsive odour, and it reddened strongly blue paper tinged by turnsole. Three ounces of this grease were given to a vigorous, well-formed dog: an hour after his extremities became violently convulsed; he cried piteously, he refused to eat, his eyes were suffused, pupils dilated, skin cold, and arterial

pulsation scarcely perceptible. In this state he continued for thirty hours, after which he slowly recovered. [*Hufeland's Journal.*

Method of Marking Linen.

The necessity of marking the linen of hospitals, &c. in a perfect and durable manner, so as to resist the action of alkalies, soap, &c. is so important as to have induced M. Henry to examine the methods in use, and endeavour to replace them by a better. The sulphate and muriate of manganese, the sulphate and acetate of iron, nitrate of silver, acetate of alumine and iron, and acetate of lead, mixed with gum or indigo, or ink, have been used for the purpose; but all either require previous or subsequent operations of some nicety, as immersion in carbonated alkalies or hydro-sulphurets, or else such degree of care as to be inexpedient in the hands of the women or persons to whom the duty generally devolves.

The following is the process which M. Henry ultimately recommends as the very best. Take one part, by weight, of iron filings, and three parts of vinegar, or acetic acid of s. g. 1056. Mix the filings with half the vinegar, and agitate it continually. As it thickens, add the rest of the vinegar, and also one part of water. Then apply heat to assist the action, and when all the iron is dissolved, add three parts of sulphate of iron, and one part of gum arabic previously dissolved in four parts of water. These are to be mixed well at a gentle heat, and will yield twelve parts of the preparation.

When to be used, the linen is to be spread on a table, and the preparation applied by means of a hair brush, and stencil plates of copper.—*Jour. de Pharm.* 1831, *p.* 388.

New applications of Artificial Ultramarine.

It is well known that a few years since M. Guimet discovered a process of manufacturing ultramarine from its proximate elements, and without the use of lapis lazuli. He has latterly described a great extension of this, his manufacture, in a letter to M. Gay Lussac. A paper manufacturer wished to apply this ultramarine in place of smalt to the colouration of his papers, and was, in consequence, supplied with a sufficient quantity to make a large experiment. The latter paper made had as good a tint as that coloured with smalt, and was more uniform, but it was found that, in producing this effect, the one pound of ultramarine, because of its extreme division and intense colour, was as effectual as ten pounds of the finest smalts. After this, 200 lbs. of ultramarine were sold to the paper makers of Lyons at the price of twenty francs per pound, and proved to be more economical than smalt. In consequence, M. Guimet has very much extended his manufactory, and is able to sell ultramarine for these uses at the price of sixteen francs per pound.

The ultramarine for painters requires a particular purification, as well as careful selection from all that is manufactured. The price

for the finest quality is sixty francs the pound. The second quality is twenty francs the pound.

Besides its use in paper making, the manufacturers of calicoes, muslins, &c. &c. are beginning to use it, and M. Guimet expresses a hope, that shortly France will be entirely independent of other countries for the blues required for these uses.

[*Ann. de Chimie*, xlvi. 431.

A machine for drilling Cast Iron, used in the manufactory of Monsieur Calla.

This machine which acts upon the principle of the stock and bit, is simple and solid, being composed entirely of iron. It works with as much regularity as promptitude.

The block to be perforated, being firmly fixed upon a solid plank, the drill is brought down upon it. The operation consists in turning a fly, which plays upon a roller, a cord from which is fastened to the lever which brings down the drill. The moving power being acted upon, the tool turns with considerable rapidity; but as the weight of the apparatus would not be of itself sufficient to urge it forward in proportion to the progress of the drill, the fly is kept constantly turning.

When the hole is perforated the tool is withdrawn by raising the apparatus, which preserves its vertical position, whatever may be the degree of elevation or depression of the lever to which it is suspended.

[*Rep. Pat. Inv.*

Resistance opposed to Water moving in Pipes.

Notwithstanding the endeavours made to deduce formula from experiments on the passage of water through tubes, so as to assist and guide the engineer in laying down pipes to supply manufactories or towns, yet frequent mistakes have occurred: thus at Paris, at the *Fountaine des Innocens*, only two-thirds of the water calculated upon were obtained; whilst in the *faubourg St. Victor*, only the half of that expected issued from the pipes. These differences appear to result from experiments made on too small a scale, or with apertures disproportionate to the areas of the tubes; for the results of practice come sufficiently near to the formula of MM. Prony and Eytelwein, when the velocity of motion in a pipe was small in consequence of a contracted aperture made in a plate of metal being used. When the contracting plate was altogether removed, then the product in water was a fourth or third less than that given by the formula; from which M. D'Aubuisson concludes that the resistance increases with the velocity in a greater ratio than that given to it in the calculations; where it is supposed to increase proportionally $a\,v^2 + m\,v$, m being nearly equal to 0.055, and v representing the mean velocity.

In consequence of the arrangement and state of the water pipes at Toulouse, some large and accurate experiments have been made

there by MM. Castel and D'Aubuisson, the systems of pipes of 4.7 inches and 10.63 inches in diameter, and 1434 and 1986 feet in length. In these experiments the quantity of water passed and the pressure were varied; the results were noted and also calculated by the formula, so as to deduce the loss of pressure due to the resistance of the pipes; that, by calculation, came out 27., 25., 32.7, and 31.7 per cent. below the result of experiment. As the two latter were the principal experiments, it is concluded that, generally, calculation gives the resistance nearly one-third less than what is obtained by actual and careful practice.—*Ann. de Chimie.*

Machine for Cutting Veneering Wood into thin sheets, and of every length.

This machine, employed in Russia, possesses this peculiarity; that instead of cutting the wood from the flat and thick surface, it carries off from its circumference a continuous shaving; the result of which is, that leaves of an indefinite length are produced, agreeably veined and knotted.

The construction is simple, combining the advantage of cutting the precious woods without waste, and very rapidly, to an extraornary extent, and so thin that they have been employed for the covering of books, and for lithographic and other engraving. One hundred feet in length of veneering may be cut in the space of three minutes.

They begin by placing the timber from which the leaf is to be cut, upon a square axle; when it is revolved and made circular with a turner's gouge. The blade of a plane of highly tempered steel, and rather longer than the cylinder, is fixed at the extremity of a frame six or seven feet in length, in such a manner as to exert a constant pressure upon the cylinder, and pare off a sheet of an equal thickness, which folds upon another cylinder like a roll of linen. The frame to which the blade is attached, is moveable at its lower extremity, and as it is charged, it depresses in proportion as the mass diminishes in substance. That this depression may be progressive and perfectly regular, the inventor has appended a regulator to the machine, consisting of a flat brass plate, preserved in an inclined position, upon which the frame descends as the regulator itself is advanced. The motion is communicated to the cylinder by means of several cog wheels, which are turned by a crank. [*Ib.*

Improvement in the mode of making Paper for Writing, Printing, and Wrapping from Wood.

The wood is reduced to shavings of the ordinary jack-plane shaving size, so as to be rendered nearly of the same size: these are then placed in a cistern or boiler, sufficiently large, and covered with water which is raised to the boiling point of heat. To every one

hundred pounds of the wood so reduced, from twelve to eighteen pounds of alkali, either vegetable or mineral, are put, in proportion to its quality for strength. If salts are used, they should be reduced before they are placed on the wood. They may, however, be put in with the water and wood before reduction, but the first method is the most preferable. Should lime be used, there must be a sufficient quantity in all cases to equal twelve pounds of pure black salts. One hundred pounds of wood will, if well attended to, make from five to seven reams of paper. [*New Monthly Mag.*

Meteorological Observations for March, 1832.

Mont. Days.	Therm. Sun rise.	Therm. 2 P. M.	Barometer. Sun rise.	Barometer. 2 P. M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
								Inches.	
☉ 1	26°	43°	Inches. 30.30	Inches. 30.30	17	NE. SW.	Moderate.		Clear day.
2	32	51	.30	.34	34	E. E.	do.		Cloudy—clear.
3	41	58	29.84	29.84	32	SW. W.	Blustering.		Flying clouds—clear.
4	28	53	30.00	.95	30	W. SW.	Moderate.		Clear—overcast.
5	45	52	29.60	.50	48	SE. W.	do.	.44	Rain—cloudy.
☽ 6	36	50	.50	.50	34	W. W.	Blustering.		Flying clouds—cloudy.
7	31	48	.80	.80	25	W. W.	do.		Clear day.
8	33	55	30.10	30.10	30	W. SW.	Moderate.		Clear day.
9	35	60	.10	.00	37	SW. S.	do.		Clear—hazy.
10	33	63	.00	.10	45	SW.	do.		Fog—cloudy.
11	39	58	.00	.00	38	S. SE.	do.		Showers—cloudy.
12	63	67	29.80	29.60	62	SW.	do.	.65	Rain—cloudy—thund. sh.
13	44	56	.50	.60	44	W.	do.	.15	Clear day—snow and rain
14	18	26	.70	.80	9	W.	Blustering	.4	Cloudy—flying clouds.
☉ 15	18	36	30.20	30.30	10	N. W.	Moderate.		Clear day.
16	26	50	.20	.30	26	S. SW.	do.		Clear day.
17	41	42	29.70	29.50	30	NE. W.	Blustering.	.48	Rain—snow and rain.
18	11	24	.70	.80	1	W.	do.		Cloudy day.
19	17	31	30.15	30.15	4	W.	Moderate.		Clear day.
20	31	47	29.95	29.95	31	SW. S.	do.		Cloudy day.
21	40	44	.55	.55	26	W.	Blustering.		Cloudy—flying clouds.
22	26	36	.70	.60	12	W.	do.		Clear day.
23	26	54	30.00	30.00	26	E. S.	do.		Hazy—clear.
24	44	68	29.90	.90	41	SW.	Moderate.		Cloudy—hazy.
25	44	73	.90	.80	50	SW. S.	Blustering.		Fog—clear.
☽ 26	44	44	.70	.70	45	SW.	do.		Rain—clear.
27	36	43	30.20	30.20	29	NW. W.	Moderate.	.42	Clear day.
28	31	54	.20	.20	27	W. SW.	do.		Cloudy—clear.
29	34	55	.10	.10	32	W. SW.	do.		Clear day.
30	30	54	29.90	29.90	34	SE.	do.		Cloudy—clear.
31	36	64	.5	29.90	46	SW.	Blustering.		Cloudy—clear.
Mean	33.84	50.29	29.94	29.91	34.6			2.18	

	Thermometer.	Barometer.
Maximum height during the month,	73. on 25th.	30.30 on 1st.
Minimum do.	11. on 18th.	29.50 on 5th, 6th, 13th and 17th.
Mean do.	42.07	29.92